Documentation

HiPath Cordless IP

Service Manual

A31003-C1010-S100-5-7620

Siemens Enterprise Communications
www.siemens-enterprise.com

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1 Introduction and Important Notes

1.1 Safety Information and Warnings

Work on communication systems and devices may **only** be carried out by qualified persons.

For the purposes of safety information and warnings, qualified persons are persons who are authorized to place into operation, ground, and label systems, devices, and lines in accordance with applicable safety procedures and standards.

It is absolutely essential that you read and understand the following safety information and warnings before starting installation and implementation work on the communication system or device.

You should also carefully read and observe all safety information and warnings on the communication systems and devices themselves.

Familiarize yourself with emergency numbers.

Types of safety information and warnings

The following grades of safety information/warnings are used in this manual:

DANGER

Indicates an immediate danger that could result in death or serious injury.

WARNING

Indicates a general danger that could result in death or serious injury.

CAUTION

Indicates a danger that could result in injury.

NOTE: Indicates situations that could result in damage to property and/or loss of data.

Symbols for specifying the source of danger more exactly

The following symbols are not usually used in the manual. They explain symbols that may be depicted on the communication systems and equipment.

* electrostatically sensitive devices

1.2 Correct Use

The communications system may only be used for the purpose described in this document and only in connection with the additional devices and components as recommended and permitted by
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The proper use of the communications system assumes correct transport,storage, assembly and setup as well as careful operation and maintenance.

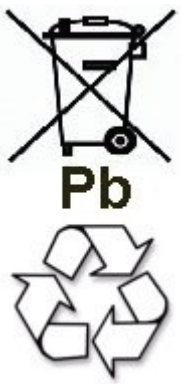
1.3 Proper disposal and recycling

All electrical and electronic products should be disposed of separately from the municipal waste stream via designated collection facilities appointed by the government or the local authorities.

The correct disposal and separate collection of your old appliance will help prevent potential negative consequences for the environment and human health. It is a precondition for reuse and recycling of used electrical and electronic equipment.

For more detailed information about disposal of your old appliance, please contact your city office, waste disposal service, the shop where you purchased the product or your sales representative.

The statements quoted above are only fully valid for equipment which is installed and sold in the countries of the European Union and is covered by the directive 2002/96/EC. Countries outside the European Union may have other regulations regarding the disposal of electrical and electronic equipment.



Used accumulators and batteries with this sign are valuable economic goods and must be recycled. Used accumulators and batteries that are not recycled must be disposed of as hazardous waste with full observance of all regulations.

1.4 Standards and Guidelines on Installation

1.4.1 Labeling

CE

This device complies with the EU guideline 1999/5/EEC as confirmed by the CE certificate.

This device has been manufactured in accordance with our certified environmental management system (ISO 14001). This process ensures that energy consumption and the use of primary raw materials are kept to a minimum, thus reducing waste production.

1.5 Data Protection and Data Security

This system processes and uses personal data for purposes such as call detail recording, displays, and customer data acquisition.

In Germany, the processing and use of such data is subject to various regulations, including those of the Federal Data Protection Law (Bundesdatenschutzgesetz, BDSG). For other countries, please follow the appropriate national laws.

The aim of data protection is to protect the rights of individuals from being adversely affected by use of their personal data.

In addition, the aim of data protection is to prevent the misuse of data when it is processed and to ensure that one's own interests and the interests of other parties which need to be protected are not affected.

The customer is responsible for ensuring that the system is installed, operated and maintained in accordance with all applicable labor laws and regulations and all laws and regulations relating to data protection, privacy and safe labor environment.

Employees of Siemens Enterprise Communications GmbH & Co. KG are bound to safeguard trade secrets and personal data under the terms of the company's work rules.

In order to ensure that the statutory requirements are consistently met during service – whether on-site or remote – you should always observe the following rules. You will not only protect the interests of your and our customers, you will also avoid personal consequences.

A conscientious and responsible approach helps protect data and ensure privacy:

- Ensure that only authorized persons have access to customer data.
- Take full advantage of password assignment options; Never give passwords to an unauthorized person orally or in writing.
- Ensure that no unauthorized person is able to process (store, modify, transmit, disable, delete) or use customer data in any way.
- Prevent unauthorized persons from gaining access to storage media, such as backup CDs or log printouts. This applies to service calls as well as to storage and transport.
- Ensure that storage media which are no longer required are completely destroyed. Ensure that no sensitive documents are left unprotected.

Work closely with your customer contact; this promotes trust and reduces your workload.

1.6 Documentation Feedback

If you have questions that are not answered by this document:

- Internal employees should contact their National Support Center.
- Customers should contact their retailer or the Siemens Customer Support Center.

When you call, state the title, ID number, and issue of the document.

Example:

- **Title:** HiPath Cordless IP, Service Documentation
- **ID number:** A31003-C1010-S100-1-7620
- **Issue:** 1

2 Overview

The HiPath Cordless IP solution extends the scope of the DECT standard introduced for voice communication, making it now available for Voice over IP infrastructures.

The radio range covered by the HiPath Cordless IP system is made up of DECT IP base stations that together form either an seamless network of overlapping and synchronous radio cells or individual radio islands. The size of a radio cell depends on local/structural factors.

Voice over IP infrastructures are connected via the SIP protocol. In their capacity as mobile communication solutions, DECT radio cells are therefore an optimal enhancement to SIP-compliant Voice over IP systems.

The DECT IP base stations support seamless handover in ongoing voice connections, that is, moving from one radio cell to another during a call with a DECT handset. The roaming function is also available for mobile stations.

HiPath Cordless IP also supports the DECT protocol GAP (Generic Access Profile) and the radio protocol PN-CAP. The basic function scope required by ETSI is thus extended to include a number of Siemens-specific features.

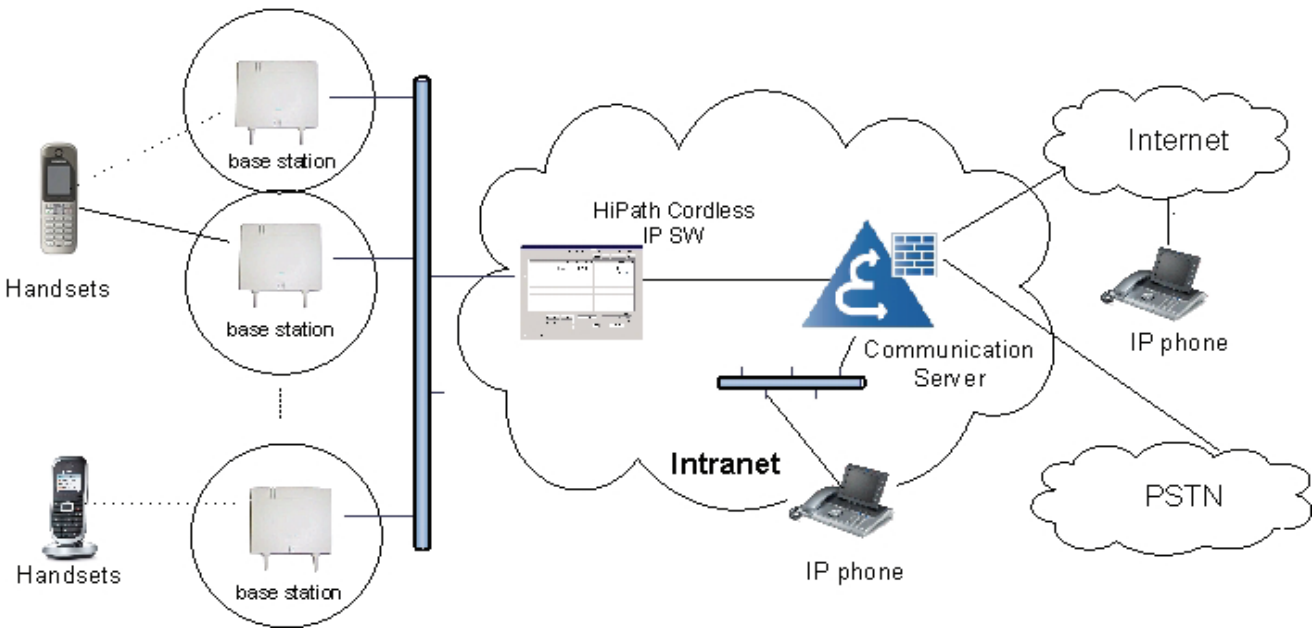


Figure 1 General Overview of the HiPath Cordless IP System

The HiPath Cordless IP System contains the following main components, see also Figure 1:

- **Handset**: Gigaset professional DECT handsets with PN-CAP functionality
- **BSIP1**: DECT IP Basestations with GAP/ PN-CAP functionality to the handset and IP interface to the Ethernet network.
- **HiPath Cordless IP SW**: central Server SW component for control of the DECT IP Basestations, SIP interworking with the communication server, and the common administration and configuration interface of the whole HiPath Cordless IP solution. The HiPath Cordless IP Server SW can either be located on one of the DECT IP Basestations or on a dedicated Server HW.

2.1 Einleitung

The HiPath Cordless IP solution is designed as a DECT system with an SIP interface to the communication server.

2.1.1 DECT IP Base Station (BSIP1)

DECT IP base stations combine to form a network of radio cells. Roaming between radio cells is possible for DECT handsets during a voice connection if the radio cells are synchronized and overlap.

DECT IP base stations come with all necessary software for the DECT and IP functions. This software is configured and administered via the HiPath Cordless IP SW.

2.1.2 HiPath Cordless IP SW

HiPath Cordless IP SW is installed once on a system and can be activated on a DECT IP base station or can be installed on a server HW. It supports the following functions:

Function: Router and protocol converter

The HiPath Cordless IP SW serves as the interface between the IP DECT base stations and the communication server.

It manages the voice connections between the communication server and the relevant DECT IP base station and converts these into a data format that can be reed by the DECT IP base stations. At DECT layer the media packets are enhanced with DECT signaling (time frame, frequency) information. The HiPath Cordless IP SW converts incoming RTP media data into UDP packets via DECT codec G726.

Only HiPath Cordless IP SW knows, at which DECT IP Basestation a special DECT handset is located. For the communication server or any other phone, the HiPath Cordless IP SW is the endpoint. Whenever a handset performs a handover, this process is invisible outside the HiPath Cordless IP System. In the view of the communication server the HiPath Cordless IP SW is like a Gateway User-Agent that manages lots of handsets. Handsets use the HiPath Cordless IP SW for registration at the communication server. This software regulates the check-in procedure for the DECT handsets and their management.

Function: Configuration and administration interface

All administrative functionality for the DECT IP Basestations as well as for HiPath Cordless IP SW itself is performed via a Web Based Management to the HiPath Cordless IP SW, i.e., all DECT IP Basestations are administered via HiPath Cordless IP SW.

Function: Synchronization management

DECT IP base stations must be perfectly synchronized as a prerequisite for seamless handover. If the DECT IP base stations are synchronized, they combine to form a seamless handover cluster. The synchronization management function only works in this cluster. Additional clusters are possible but not synchronized. Seamless handover is not possible between different asynchronous clusters.

In DECT systems with line-switched connections such as HiPath Cordless systems, the synchronization information needed for synchronizing the DECT IP base stations is obtained from the UP0 connection. This is not possible in the HiPath Cordless IP system.

DECT-based synchronization ("synchronization over the air")

This method to synchronize overlapping radio cells runs under SW control within the DECT part of the DECT IP Basestation. The HiPath Cordless IP SW is acting only as admin point that notices when a base station has lost its synchronization.

The DECT IP base station must be located in the overlap area of the DECT IP base station that it wants to synchronize with over the DECT interface. For every DECT IP Basestation the synchronization "Master" have to be configured by the configuration Interface of the HiPath Cordless IP SW. DECT information for synchronization are exchanged directly between the DECT IP Basestations.

A DECT IP base station can also be synchronized with other DECT IP base stations as this increases the synchronism available in the cluster. It is important to avoid synchronization loops.

In the event of loss of synchronization, the DECT IP base station stops accepting calls once all ongoing calls that were being conducted on the asynchronous DECT IP base station have ended and then it re-synchronizes the asynchronous DECT IP base station.

LAN-based synchronization

A DECT IP base station can be synchronized over LAN with another DECT IP base station. The IEEE standard Precision Time Protocol (PTP) IEEE1588 is used for this. In contrast to DECT-based synchronization, LAN-based synchronization uses only one DECT IP base station in the cluster as the clock master for the other DECT IP base stations to be synchronized. This PTP master sends out multicast messages with time information. The slaves send back modified time messages to the master.

In contrast to over-the-air synchronization, LAN-based synchronization requires less configuration.
On the other hand, high demands are placed on Ethernet characteristics such as symmetry, packet loss, delay, jitter (primarily delay variation). All of the Ethernet components involved (especially the switches) therefore have to fulfill special

requirements. If thresholds are exceeded (primarily jitter), this leads to loss of synchronization, which in turn leads to a resynchronization process. No calls can be conducted on the relevant DECT IP base station during this process.

PTP messages are exchanged only between the DECT IP Basestations, the HiPath Cordless IP SW is not involved.

DECT IP Basestations who are e.g. separated by iron doors cannot synchronize each other over the air can use instead PTP.

For PTP, the underlying network must fulfill some restrictions like very little delay, i.e., no routers or NAT devices (see chapter Section 2.4).

A combination of air and LAN synchronization is possible in a cluster of synchronous DECT IP base stations.

Advantages of LAN synchronization compared with over-the-air synchronization:

- Greater flexibility in the arrangement of the base stations as no synchronization chains need to be formed.
- Fewer DECT IP base stations required as the overlapping area of the DECT IP base stations is smaller.
- Configuration of the system is simplified as all DECT IP base stations can be synchronized on one synchronization master.

In the event of loss of synchronization, the DECT IP base station stops accepting calls once all ongoing calls that were being conducted on the asynchronous DECT IP base station have ended and then it re-synchronizes the asynchronous DECT IP base station.

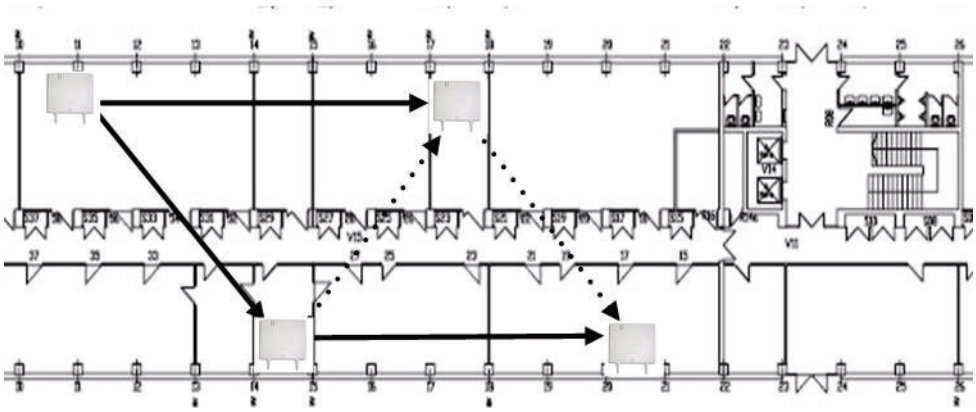


Figure 2 *Optimum system synchronization over DECT at synchronization over the air*

Standard synchronization

Alternative synchronization if standard synchronization fails

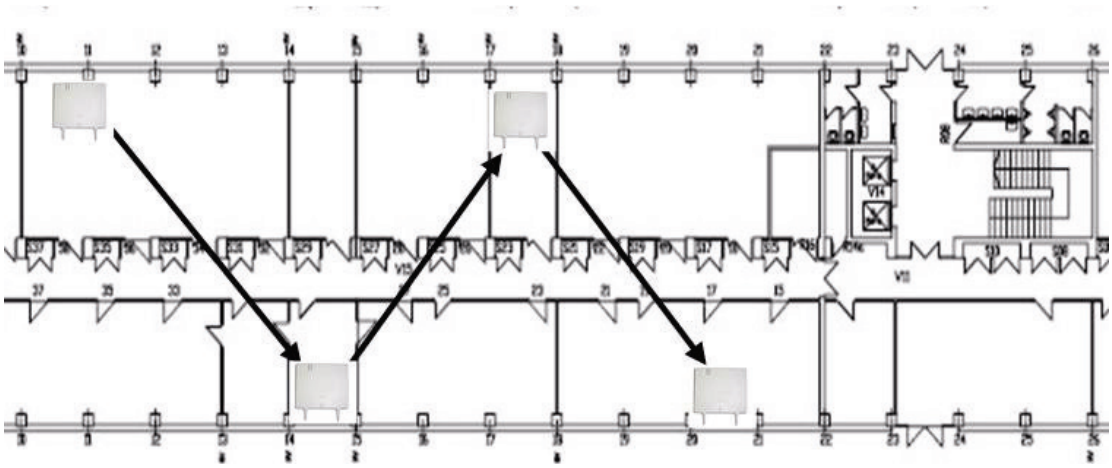


Figure 3 *Not optimally synchronized, each DECT IP base station has only one synchronization partner*

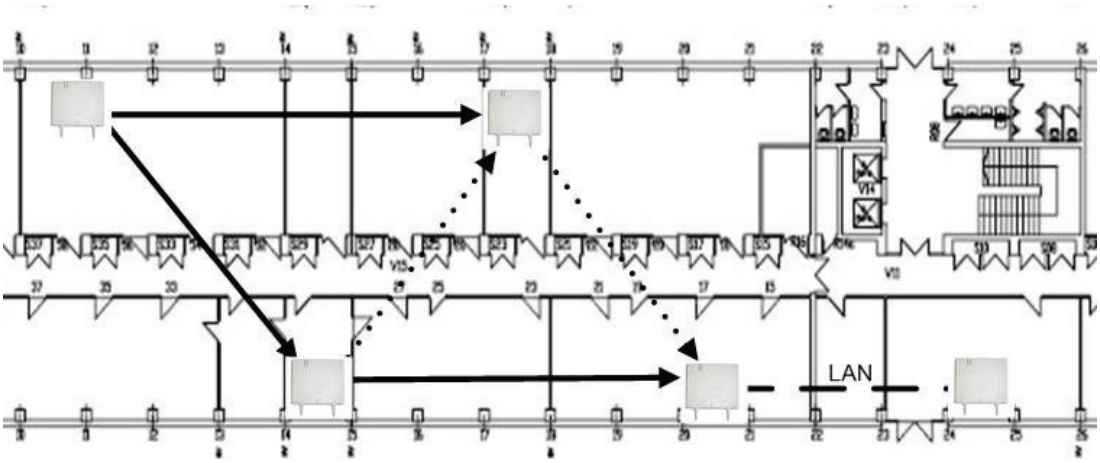


Figure 4 *The two lower DECT IP base stations are synchronized over LAN because a solid fire door prevents DECT-based synchronization. The quick passage of data through a fire door cannot always guarantee reliable DECT synchronization.*

This data is transported in a VPN tunnel to ensure that the signaling and voice data in active voice connections between a DECT IP base station and HiPath Cordless IP software is protected against manipulation and interception. For the VPN encryption IPSec is used.

The DECT IP base stations are set up in communication with the HiPath Cordless IP SW. As soon as a new DECT IP base station is connected to the Ethernet, it starts to send multicast packets with its MAC address. The HiPath Cordless IP SW then activates and takes over control of the DECT IP base station. The HiPath Cordless IP SW then sends the DECT IP base station an IP address for communication purposes as well as its own IP address as a future target address for data traffic.

2.1.2.1 Communication Interfaces

The following picture gives an overview of the protocols used between DECT Handset, DECT IP Basestation, HiPath Cordless IP SW and the communication server.

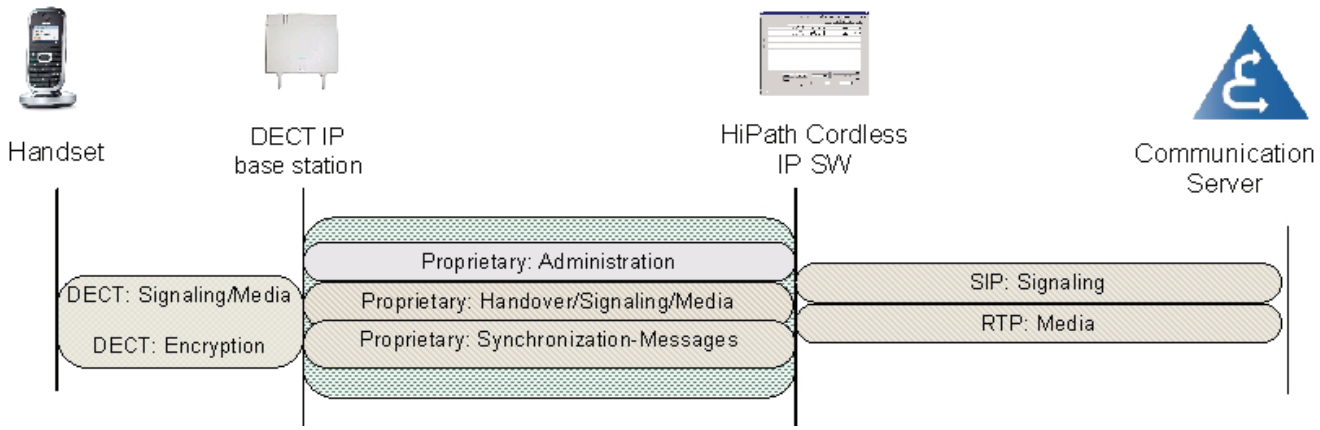


Figure 5 *Protocols of the path between Handset and Communication Server*

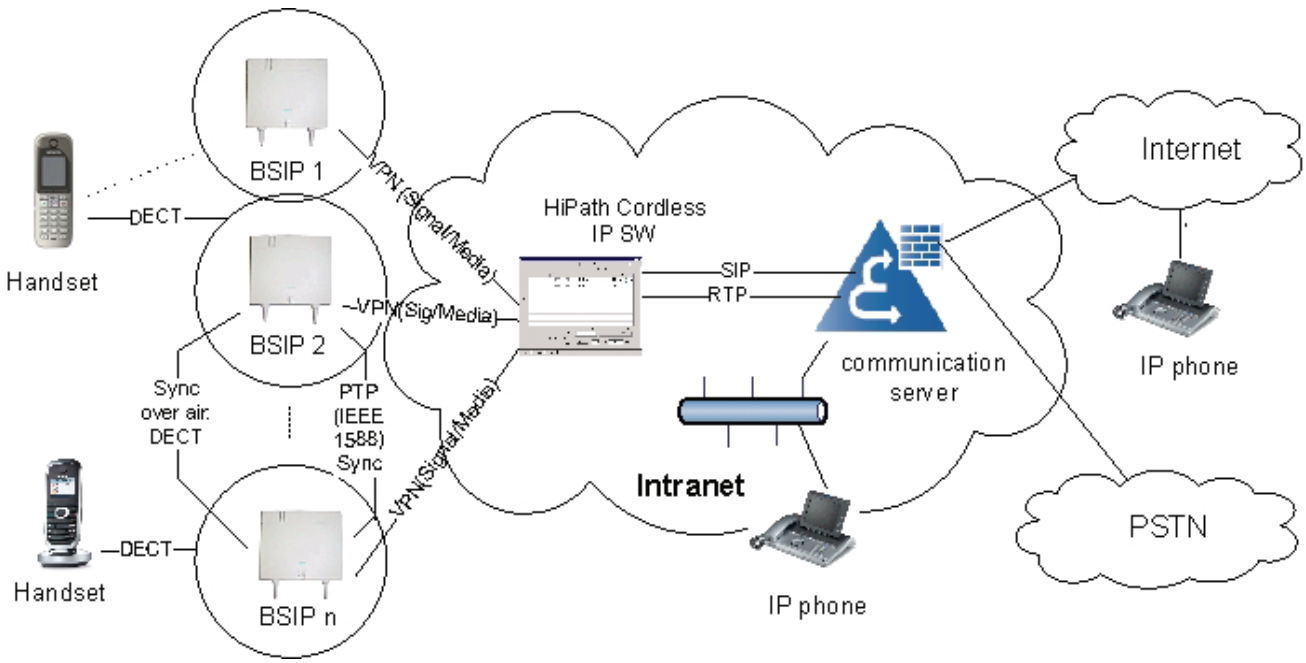


Figure 6 *Depicts all communication channels of the HiPath Cordless IP System*

The following list gives an overview of all communication-channels within the HiPath Cordless IP System:

DECT Handset - User: Gigaset professional DECT Handsets with PN-CAP functionality

DECT Handset - DECT IP Basestation (BSIP1): In this multicell DECT system, a call can be handed over seamlessly from one BSIP1 to the other. If seamless handover is impossible and the signal quality is decreasing, at a certain point the handset can send a warning tone and the connection breaks off.

DECT IP Basestation (BSIP1) - DECT IP Basestation (BSIP1): An accurate synchronization is needed between DECT IP Basestation for seamless handover.

DECT IP Basestation (BSIP1) - HiPath Cordless IP SW: the DECT IP Basestation (BSIP1) is able to handle a tunnel to the HiPath Cordless IP SW, in which the voice data of all active calls and all signaling data is transported. The connection between BSIP1 and HiPath Cordless IP SW is system-specific, i.e., this protocol is IP based and uses UDP packages both ways.

HiPath Cordless IP SW - communication server: The SIP interface between the HiPath Cordless IP SW and the communication server is standard based. Seen from the communication server the DECT over IP System is a set of SIP subscribers represented by a GW User-Agent, which is the HiPath Cordless IP SW connected to the DECT handsets, i.e. the subscribers are the DECT handsets.

2.2 System Configuration

There are two main scenarios for installing the HiPath Cordless IP solution:

- The HiPath Cordless IP SW is activated on one of the DECT IP base stations.
- The HiPath Cordless IP SW is installed on a server.

In both cases, all voice and signaling data (RTP/SIP) are always routed over the HiPath Cordless IP SW because this is the only software that supports a routing and protocol converter function.

Scenarios are also possible where the HiPath Cordless IP SW is installed a number of times per communication server. Such scenarios do not support seamless handover between the different clusters formed with synchronous DECT IP base stations. Cascading is not available at present for communication server software.

2.2.1 Scenario 1 - HiPath Cordless IP SW is activated on a DECT IP base station

All DECT IP base stations always also support the same functions as HiPath Cordless IP SW. This means that in principle, all DECT IP base stations can perform HiPath Cordless IP SW functions in addition to the actual DECT functionality. The HiPath Cordless IP SW must be activated before the DECT IP base station can perform this function.

The following system limits apply in this scenario based on resource availability in BSIP1:

– up to 10 DECT IP base stations

– up to 10 parallel calls

These system limits apply to each cluster of synchronous DECT IP base stations where seamless handover is possible. Up to 99 Gigaset professional mobile devices can be configured in the data base of the HiPath Cordless IP SW and up to 55 of these mobile devices can be logged on to the Communication Server.

2.2.2 Scenario 2 - HiPath Cordless IP SW is installed on dedicated server hardware

The HiPath Cordless IP SW is installed on a server. The requisite operating system for the server is Linux Distribution openWRT. Both the server and the entire software on the server are included in the HiPath Cordless IP solution's scope of features.

The following system limits apply in this scenario:

– up to 60 DECT IP base stations

– up to 50 parallel calls

These system limits apply to each cluster of synchronous DECT IP base stations where seamless handover is possible. Up to 300 Gigasets can be configured in the HiPath Cordless IP software.

2.3 DECT IP Base Station Data

Table 1 Technical data DECT IP base station

Parameter	DECT IP base station BSIP1	Outdoor case
DECT Interface		
Max. amount of DECT channels	120	
DECT Signalling	GAP/ PN-CAP	
IP Interface		
Network connection	Ethernet 10/100 Base T	
PoE class	Class 2 according IEE802.3af	
Power consumption	< 6,5 W; PoE Class 2	
Max. Voice channels	12 (at G.711)	
Codecs	G.711/ G.726	
QoS	802.1 p/q	
Echo Cancellation	yes	
DHCP Option	DCHP on or local entry of IP addresses	
SW Distribution	SW Download/ Update central via HiPath Cordless IP SW	
Miscellaneous		
Dimensions (W x H x D in mm)	202 x 256 x 90	296 x 256 x 90
Weight	approx. 0,5 kg	approx. 1,0 kg

Table 1 Technical data DECT IP base station

Parameter	DECT IP base station BSIP1	Outdoor case
Operating Temperature	Indoors: 0 °C to + 40 °C	Outdoors (with outdoor housing): - 25 °C to + 40 °C
Storage temperatur range	-5 °C to + 45 °C	
Relative humidity	–	to 95 %

Figure 7 DECT IP base station BSIP1 (Item number: U30807-S5494-X)

2.3.1 Outdoor Case

A DECT IP base station must be installed in a weatherproof outdoor case to guarantee radio coverage in outdoor areas, for example on factory sites. The outdoor case is suitable for mounting on house walls, roofs or masts.

The outdoor case already used for the HiPath Cordless base station BS4 is also used for DECT IP base stations (part number: S30122-X7469-X2).

If using the DECT IP base station outdoors, lightning and overvoltage protection must be provided and guaranteed for the DECT IP base station itself as well as for the feeder into the DECT IP base station and the building. In compliance with EN 61000-4-5, the power supply inlet on the DECT IP base station offers up to 0.5 KV overvoltage protection.

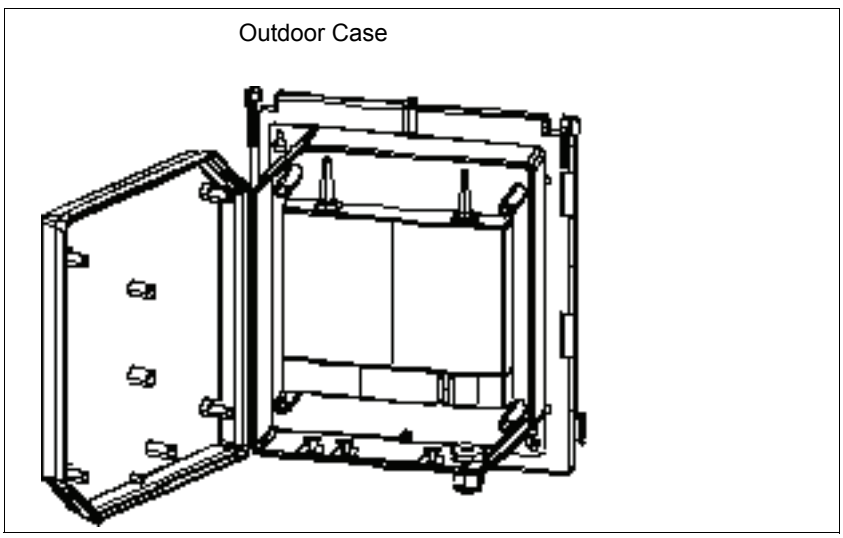


Figure 8 Outdoor case with DECT IP base station

2.3.2 Powering the DECT IP Base Stations

The DECT IP base station can be powered in two different ways:

- Power-over-Ethernet (PoE) Class 2 to 802.3af
- Power-over-Ethernet: PoE injectors

A PoE injector is used if PoE cannot be made available in the network. The PoE injector must be 802.3af-compatible. Pre-tested and released PoE injectors are available as optional features within the scope of the HiPath Cordless IP solution.

The IEEE802.3af standard allows the PoE Injector to be in any location between the switch and the BSIP1. The maximum allowed distance between the switch and the BSIP1 for IEEE802.3 compliance is 100 m. It is typical to deploy the PoE Injector close to the switch, since by doing this one can use a single UPS (central power supply) to backup both the switch and the PoE Injector.

If overall efficiency is more important than centralized backup and/or management, it makes sense to place the PoE Injector closer to the BSIP1, since the power dissipated at the cable between the PoE Injector and the BSIP1 is directly proportional to the length of this cable ($P = I^2 * R$).

Figure 9 PoE Injector

2.4 Network Requirement

Voice connections only work properly over IP networks if the IP network satisfies all general VoIP network requirements in terms of delay, loss and guaranteed quality of service features.

The following conditions should also be assured for the DECT IP base stations and the HiPath Cordless IP SW in the IP network:

- they have to be part of the same Ethernet segment, a layer-3 routing via an IP router is not supported,
- no devices use the Network Address Translation (NAT) Ethernet segment
- Minimum 2 priority classes acc. to IEEE 802.1 p/q in the IP Network possible
- Use of 100 Mbps full duplex for all switched LAN ports
- as the solution operates with standard IP addresses, these must be freely available in the IP network.

Failure to satisfy these conditions can result in delays in the IP network. This leads to synchronization and voice quality problems in the DECT handsets.

2.5 Software License Management

SW component licensing is only relevant if the HiPath Cordless IP SW is installed on dedicated server hardware. If the HiPath Cordless IP SW is activated on a DECT IP base station, licensing is not performed for the software components of HiPath Cordless IP systems. The SW licensing of the communication server's SIP stations is dependent on this.

If the HiPath Cordless IP SW is located on a dedicated Server HW the number of DECT IP Basestation within the system and the HiPath Cordless IP SW itself in Version 1 is licensed.

The number of DECT IP base stations configured and registered in the HiPath Cordless IP SW is counted for this. The HiPath Cordless IP SW is also counted in version 1.

HiPath License Management (HLM) is used in the HiPath Cordless IP SW. The Siemens licensing process consists of 4 different steps, see for a general overview Figure 10:

1. The license key is centrally created and contains the number of DECT IP Basestations in the system and the number of HiPath Cordless IP SW in Version 1. The license file is signed by Siemens CA.
2. The license file is being download from a License Server (CLS, Central License Server). In general, the Customer Site Components (CSC) are part of the license SW of the product that interpret the license file and distribute it in a customer's network. In detail, the Customer License Agent (CLA) - usually on the Siemens communication server - connects to the License Server and downloads the license file. Via CLA the customer can monitor the usage of licenses.

   If the CLA is located on the Siemens communication server, the license file is downloaded onto the Siemens communication server. A Customer License Client (CLC) which is always on HiPath Cordless IP SW, is told, under which link on the Siemens communication server it can contact the CLA.

   In case the customer's network does not have a Siemens communication server the HiPath Cordless IP SW itself will also be provided with CLA SW and the license file will be downloaded directly onto the HiPath Cordless IP SW. The CLC is told that the files are on the same server.
3. Verification of the license key: the license file is read in and the signature is checked. If the check is successful, the license data will be retrieved from the license file. This is done by CLA.
4. License Enforcement: the license conditions are checked and supervised in the running system, e.g., as soon as a DECT IP Basestation is installed and added to the system, the CLC contacts the CLA and a license counter in the license file is decremented. This step is performed by the Customer License Client (CLC) that is always running on HiPath Cordless IP SW.

Figure 10 shows the HiPath Cordless IP license management as part of the HiPath License Management (HLM). CLS is the Central License Server. CLA is usually installed on the same Server as the Siemens communication server. In HiPath Cordless IP SW the CLC module is integrated, which is the interface to the CLA.

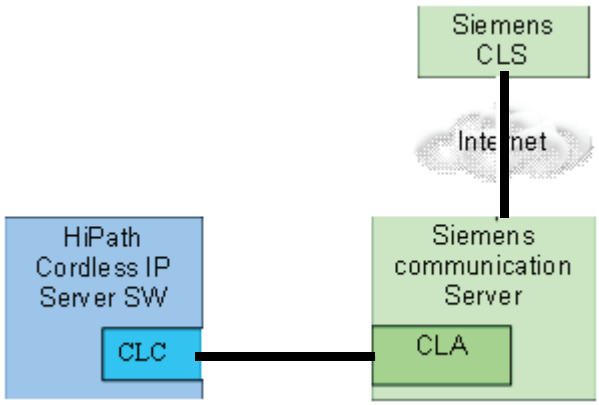


Figure 10 HiPath Cordless IP SW: License Management

When the HiPath Cordless IP System is setup at a customer, a special Grace Period starts, i.e. the product can be used for 30 days without a license. Within this period of time, the one who is installing the system has to get a valid product license. After installation of the license software on the system, this license has no more time restrictions.

For more information on HiPath License Management, refer to the manual "License Management V1.0, User Manual", Ref.No.: A31003-H2510-B100-*-7619.

3 Planning a HiPath Cordless IP System

When planning a cordless system, the position of the base station is critical for system performance. The load should be optimized using locations with a high call volumes and radio coverage.

3.1 Planning According to Call Traffic Load

- The borders of base station radio cells should not be located in high traffic areas because changing base stations during a call (handover) increases traffic load.
- The best base should be as unique as possible to avoid frequent switching.

Recommended number of DECT users (number of simultaneously registered users) for 10 voice channels in accordance with the volume of traffic (Erlang value).

10 Voice channels with 100 mErl/user (low traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	3,09 Erl	4,46 Erl
User	31	45
10 Voice channels with 150 mErl/user (normal traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	3,09 Erl	4,46 Erl
User	21	30
10 Voice channels with 200 mErl/user (high traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	3,09 Erl	4,46 Erl
User	15	22

Table 2 Recommended amount of users at 10 voice channels

Recommended number of DECT users (number of simultaneously registered users) for 50 voice channels in accordance with the volume of traffic (Erlang value).

50 Voice channels with 100 mErl/user (low traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	32,51 Erl	37,90 Erl
User	325 *	379 *
50 Voice channels with 150 mErl/user (normal traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	32,51 Erl	37,90 Erl
User	217	253
50 Voice channels with 200 mErl/user (high traffic)		
Grad of Service (GoS)	0,1 %	1 %
Traffic	32,51 Erl	37,90 Erl
User	163	190

Table 3 Recommended amount of users at 10 voice channels

(*) At the time an amount of 300 Gigaset professional (subscriber) is possible, althoug theoretically a higher amount of Gigaset professional would be possible according to traffic intensity.

3.2 General

DECT IP Base station (BSIP1)

DECT IP base stations are logically connected to the HiPath Cordless IP server software over LAN connections. This software is connected to the communication server via the SIP interface.

- Base station range
  - Ethernet cable range (see also Chapter 2.4 for network requirements between DECT IP base stations and the HiPath Cordless IP server software)
  - Spatial distance
    The distance which must be maintained between the different installation points of the base stations is dependent on
    - the range
    - the traffic capacity of the radio cells.
      You can increase the number of simultaneous calls in a radio cell by overlapping radio cells (overload).
    - Distance
      For synchronization over DECT, the DECT IP base stations you want to synchronize with each other must be able to exchange their management information (beacons). For this to work, they must be located in the areas where their radio cells overlap.
      This does not apply for use of over-the-air synchronization.
  - Overlap areas inside/outside buildings (see following chapter), measurement results (RSSI points).

Radio measurement techniques are used to determine the radio range of DECT IP base stations.

DECT IP base stations inside buildings

- Please note that the base station's connection cable can be repositioned as necessary (connection cable plus reserve loop to be factored in).

DECT IP base stations in areas outside buildings (e.g. campuses).

- The base station must be installed in the outdoor case for use is exterior areas.
- Make sure that adequate lightning and overvoltage protection is provided for the cable feeder into the building and the DECT IP base station

- Radio propagation

  Radio propagation is negatively influenced by

- obstructions with strong absorption qualities (brick walls, dividing walls, ceilings, furniture, steel cabinets, bathroom units, elevators, wire-reinforced glass, leaded windows, blinds and others)
- reflective stationary obstructions (brick buildings, reinforced concrete buildings, buildings with metal sheathing)
- reflective moving obstructions (people, animals, vehicles)

3.3 Propagation Conditions for Radio Traffic

Radio wave propagation in the DECT frequency range is quasioptical. This means that a wave is hindered in its propagation if it hits a solid surface and is thereby reflected to a greater or lesser extent. This reflection is dependent on the physical qualities of the medium.

In the case of conductive materials, the penetration depth into the medium is determined mainly by the magnetic quality and the electrical conductivity.

- Metals with a high degree of conductivity
  These include copper or steel and prevent most DECT frequency radio waves from penetrating, reflecting them in the same way as a mirror reflects light.
- Modern construction materials (exceptions, see above)
  These have relatively poor conductivity levels with the result that electromagnetic waves, even if attenuated, still can pass through. Thus, radio traffic is possible within and through buildings.
- Attenuation qualities
  of the construction materials vary greatly resulting in different ranges depending on the propagation direction and the construction material penetrated.
  - Wood (dry and unprocessed), glass, plastics (N-conductor) — negligible attenuation
  - Brick walls, wood (damp and processed, for example, particle board) — medium range of attenuation
  - Reinforced concrete, glass with metal reinforcement/coating — greatest attenuation

  This attenuation is mitigated by openings, especially by windows in the buildings as long as they do not have wire-reinforced or metal-plated glass.

The different levels of radio propagation give rise to various scenarios in which radio cells are formed:

- in the open with visibility
- industrial sites with reinforced concrete buildings and buildings with metal facades

- indoor areas in buildings made of brick and light construction materials
- indoor areas in reinforced concrete buildings with diverse interior layout, for example.

3.3.1 In the Open with Visibility

In this scenario, the electromagnetic waves are subject to the lowest amount of attenuation with the result that they produce the greatest radio wavelength.

In principle, base stations in such a scenario produce a radio coverage range with a radius of up to 300 m.

This, however, is usually not possible, since trees, bushes and moving obstructions, such as, people, animals, and vehicles in the direct propagation route can significantly reduce propagation.

NOTE: A base station installed in an attic directly beside a dormer window (no metal reinforcement in the window pane) is the alternative to the outdoor housing for coverage of the outdoor area.
Choose the mounting location carefully:
The base station is often exposed to extreme environmental temperatures, for example, direct sunlight or extreme cold.

3.3.2 Industrial Sites

Buildings of varying structural materials may be found here, including those:

- of light construction materials,
- of brick,
- of reinforced concrete,
- with metal facades.

The distances between the buildings, however, are rarely greater than 100 m. In this scenario, outdoor base stations are practical for covering the outdoor area.

- Buildings of brick or light construction materials
  are generally penetrable, but the magnetic field reception behind the walls is extremely low, resulting, quasioptically, in a shadowed area.

  For example, in the case of a base station installed on the southern side of a brick building, the range limit on the northern side would be attained immediately or after just a few meters, owing to the insertion loss.

Up to 100 m of the outdoor area can also be supplied through the windows. For this purpose, the base station must be set up on an upper floor (> 3rd floor, that is two levels above ground floor). Low-lying obstructions near the base station, such as, vehicles or a garage (one or two cars) do not, in this case, cause significant interference.

- Reinforced concrete buildings and/or metal facades:
  These have proven to be limiting factors. Penetration into the building is only possible through windows (up to about 2 m into the building in the case of standard size windows). The windows cannot be made from wire-reinforced or metal-plated glass.

  Wave conduction is possible in alleys between buildings as well as along streets. This results in a larger radio area.

3.3.3 Indoor Areas in Buildings in Brick and Light Construction Materials

- Insertion loss values

  In the case of walls of brick or light construction materials, insertion loss values are relatively small so that even dividing walls of up to 30 m can be penetrated.

- Vertical attenuation

  This is dependent on the ceiling type. In this case, reinforced concrete ceilings that offer higher attenuation in particular compared to brick play a decisive role in range evaluation.

  These ceilings are dimensioned based on the purpose of the building, for example,

  – single-family residence

  – apartment building

  – office building

  – theater

  and so the insertion loss a_e also differs accordingly; see Table 4.

Table 4 Insertion loss (a_e)/range loss in the radio area

Insertion object	a_e (dB)	Range loss (%)
Brick wall, 10 to 12 cm	2.5	~ 43.5
Brick wall, 24 cm, small windows	4	~ 60
Brick wall, 63 to 70 cm	4.0 to 4.5	~ 60 to 64
Drywall	1.3 to 2.3	~ 26.5 to 41
Gaseous-concrete wall	6.6	~ 78
Glass wall	2	~ 37
Wire-reinforced glass wall	8	~ 84
Reinforced concrete ceiling (residence)	6 to 9	~ 75 to 87
Two reinforced concrete ceilings	26	~ 99.5
Three reinforced concrete ceilings	46	100

NOTE: These values show clearly that propagation within buildings is hindered much less in a horizontal direction than in a vertical direction.
This must be taken into consideration when installing the base station.

3.3.4 Indoor Areas in Reinforced Concrete Buildings with Diverse Interior Layout

Indoor areas in reinforced concrete buildings can give rise to different scenarios, depending on the interior layout.

- **Scenario 1** - Large factory halls (for manufacturing or office space)

  These are either not partitioned (e.g. manufacturing halls) or have mobile partitions reaching half way to the ceiling (office).

  – Propagation conditions

    Favorable in this scenario because intervisibility is more frequent than, for example, in buildings divided into individual offices with no line of sight between the base station and mobile telephones.

- **Scenario 2** - Interior in buildings of brick and light construction materials

  – Propagation conditions

Similar to buildings with brick outer walls.
However, due to industrial sector requirements, the dimensions of reinforced concrete ceilings in these buildings are such that insertion loss values are considerably higher than in brick buildings.

NOTE: The resulting unfavorable vertical wave propagation must be taken into consideration when installing the base station.

- **Scenario 3** - Interior with concrete walls and steel dividing walls

  These areas also usually include the heavily steel-reinforced areas of

  – stairwells,

  – bathroom areas,

  – supply shafts, as well as

  – elevator shafts.

  Table 5 shows several insertion loss values which are relevant to this scenario, along with the corresponding capacity loss data for the radio area.

Table 5 Insertion loss (a_e)/range loss in the radio area

Insertion object	a_e (dB)	Range loss (%)
Concrete wall, interior, 10 cm	6	~ 75
Concrete wall, double, 2 x 20 cm	17	~ 97.5
Concrete wall, 25 to 30 cm	9.4 to 16	~ 88 to 97.5
Reinforced concrete ceiling	12 to 14	~ 91 to 96
Two reinforced concrete ceilings	35 to 47	100
Three reinforced concrete ceilings	42 to 53	100
Steel wall with wire-reinforced glass	6.5 to 10	~ 75.5 to 90
Steel walls, extending to ceiling, 3.5 m dist.	31 to 41	100

  – Propagation conditions

    Horizontal and vertical values are approximately the same. It has been determined that in this type of building, transmission usually takes place along corridors if steel divider walls are installed.

    As the relatively high insertion loss values show, individual rooms are increasingly supplied via reflection if multiple metal walls are in the direct path.

    Concrete walls cause similar conditions to those described above. Elevator shafts and stairwells must therefore often have their own base station if they are to be included in the HiPath Cordless IP range.

3.4 Determining the Installation Site

3.4.1 Indoors

3.4.1.1 In Buildings of Brick or Light Construction Materials

- Horizontal direction
  A base station must be installed at least every 50 m.
- Central installation in the building
  The general rules must be observed.
- Vertical coverage
  Care must be taken to ensure that no more than two reinforced concrete ceilings are in the direct propagation route between the base station and the area of movement of the handsets.
  Other base stations must then be set up in the radio cells if necessary, based on the concentration of stations or the number of handsets.

Assuming that the distribution of handsets in buildings will be fairly uniform, additional base stations should preferably be installed on the floors above or below the minimum required base stations (see Figure 11).

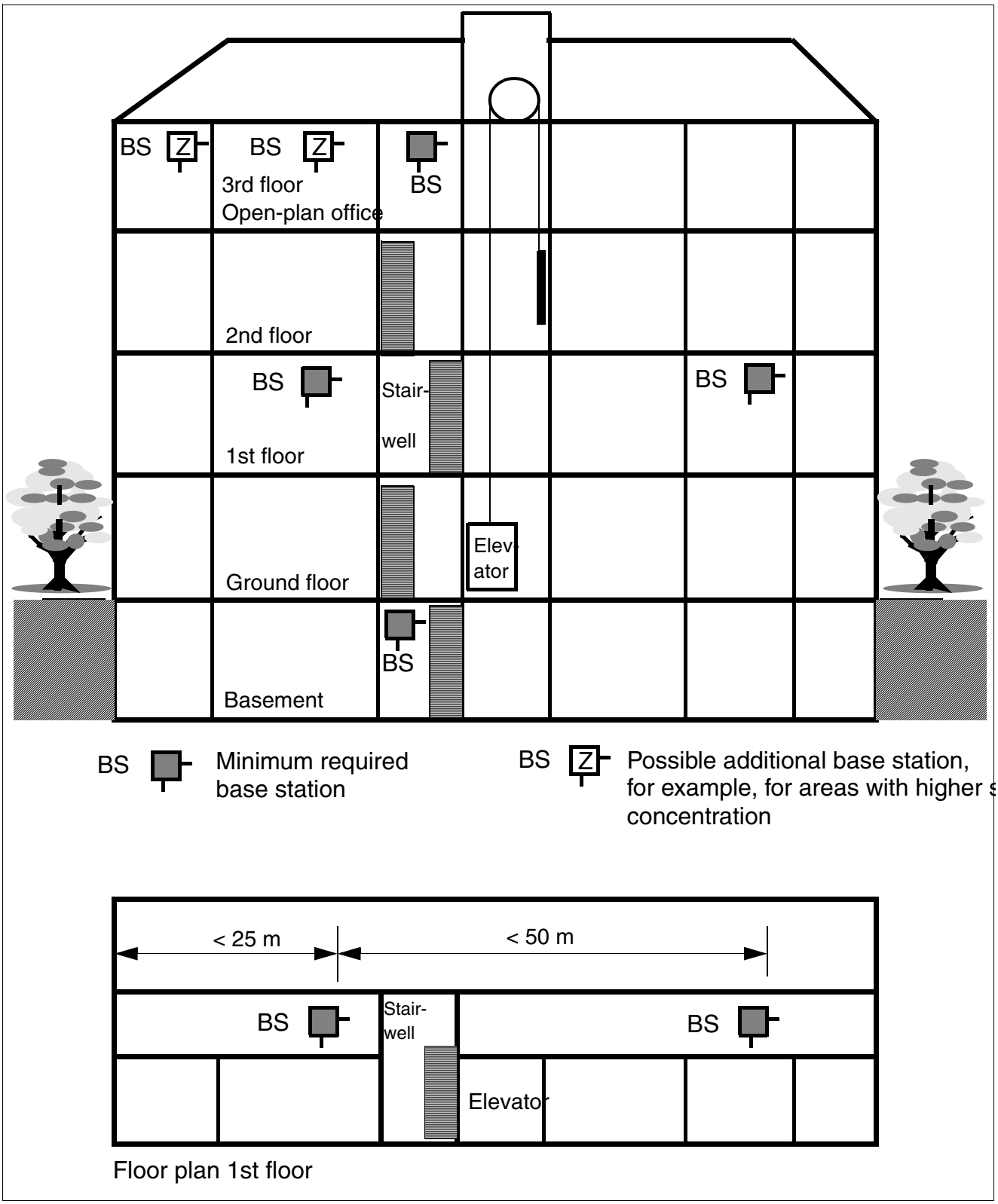


Figure 11 Base station distribution in buildings of brick and light construction materials

3.4.1.2 In Steel/Concrete Buildings

- For interiors of brick or light construction materials (Figure 12)
  - Horizontal direction
    A base station must be installed at least every 50 m.
  - Central installation in the building
    The general rules must be observed.
  - Vertical coverage
    Care must be taken to ensure that not more than one reinforced concrete ceiling is in the direct propagation route between the base station and the area where the mobile telephones are used. Adequate coverage cannot otherwise be guaranteed.
    - Stairwells,
    - elevator shafts and
    - supply shafts

    in these buildings usually have strongly-reinforced concrete walls and stairs. Areas such as these, with poor propagation conditions, often require additional base stations.
  - If additional base stations are needed because of a large number of mobile telephones, see Figure 12.

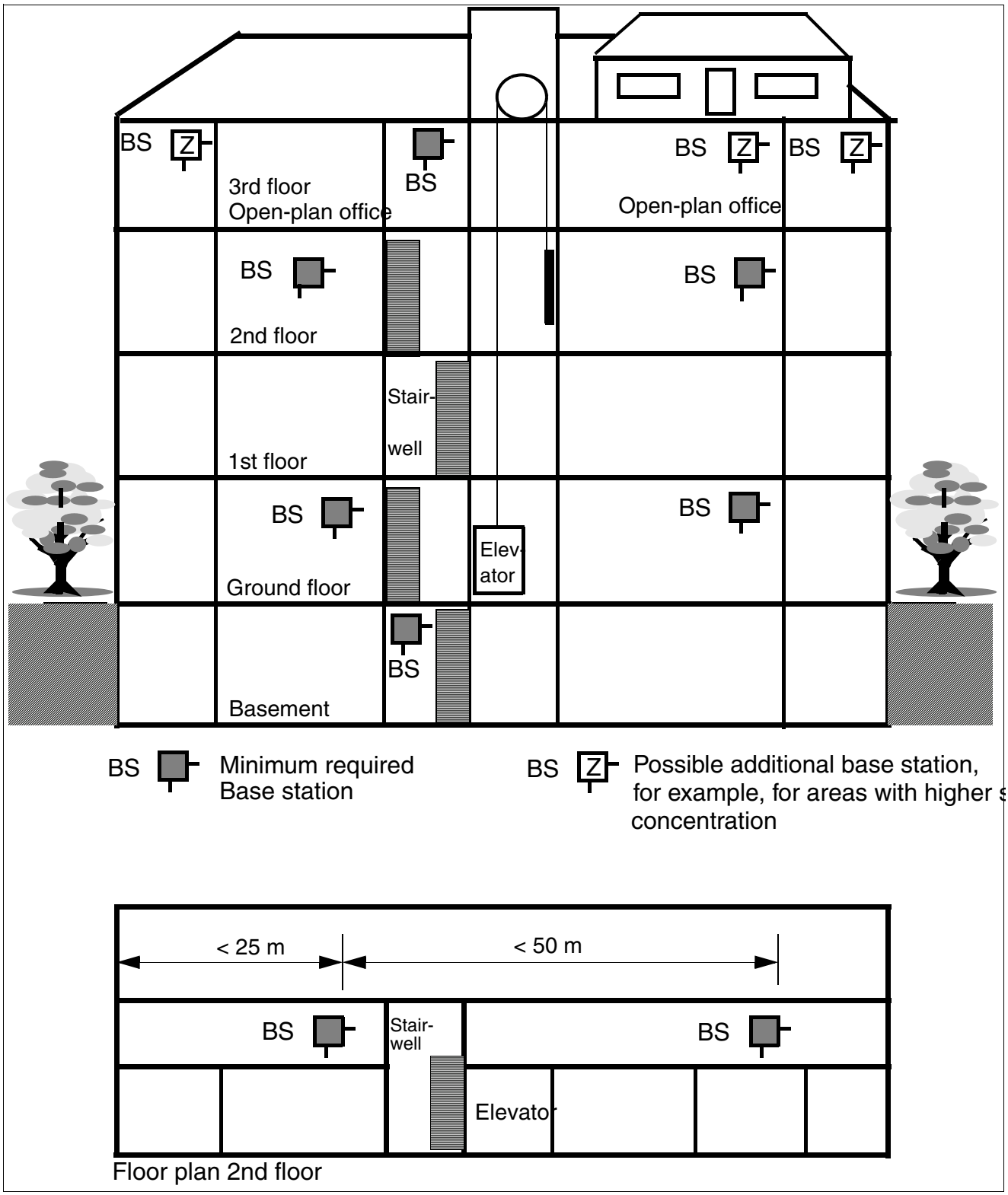


Figure 12 Base station distribution in interiors of brick and light construction materials

- For interiors with concrete and steel dividing walls (Figure 13)
  - Central installation in the building
    The general rules must be observed.
  - Horizontal direction
    Because of the relatively high attenuation of concrete and steel dividing walls, a base station must be installed in these buildings at least every 25 m.
  - Vertical coverage
    Care must be taken to ensure that not more than one reinforced concrete ceiling is in the direct propagation route between the base station and the area where the mobile telephones are used. Adequate coverage cannot otherwise be guaranteed. For
    - stairwells,
    - elevator shafts and
    - supply shafts

    additional base stations are also often necessary.
    In the case of elevators, a base station can be installed in the elevator cabin itself.
  - If additional base stations are needed because of a large number of mobile telephones, see Figure 13.

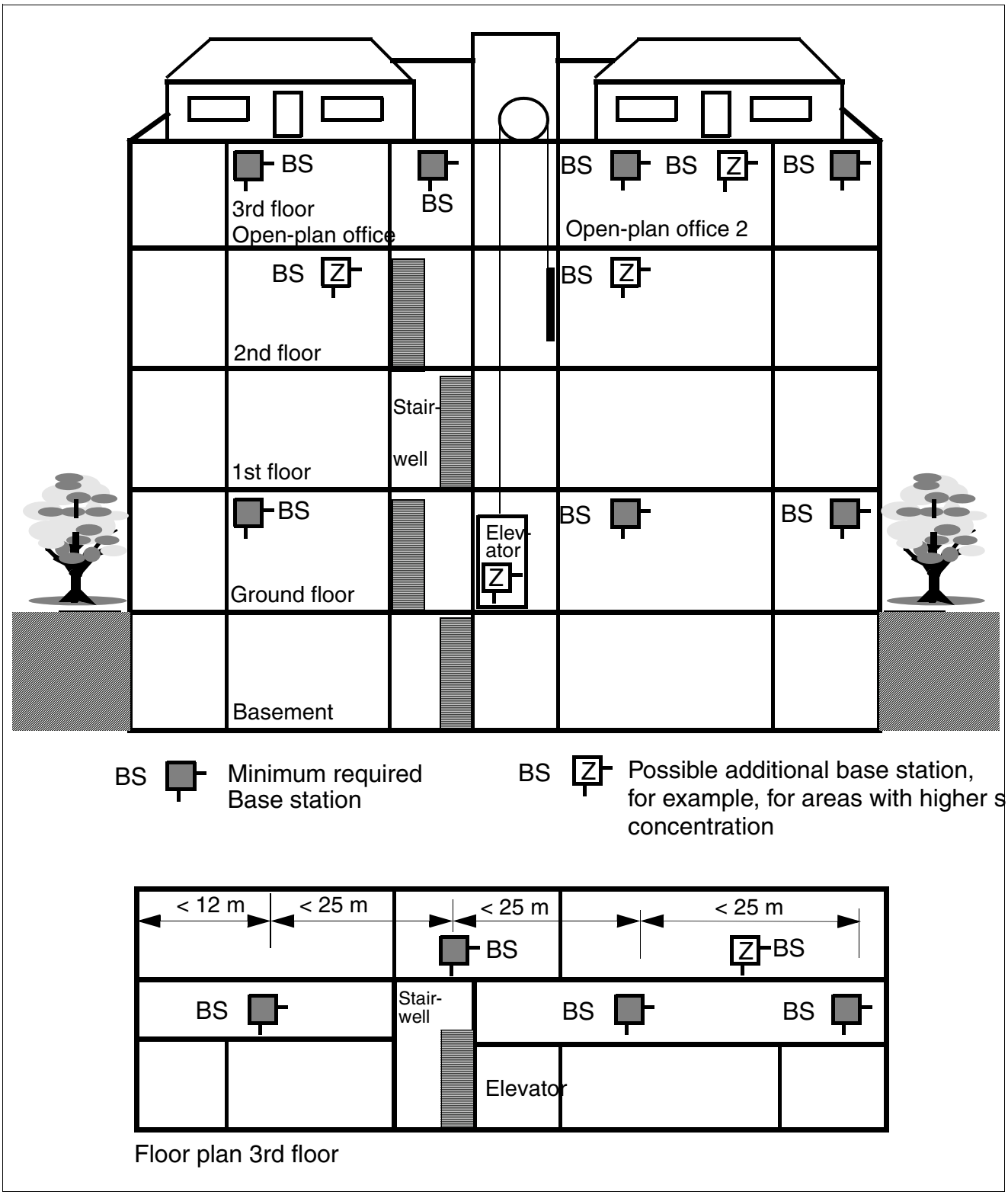


Figure 13 Base station distribution in interiors with concrete and steel dividing walls

3.4.1.3 Factory Halls and Open-Plan Offices

- Within halls or open-plan offices (Figure 12)

  Good transmission qualities.

  For a hall which is 100 m long, one centrally located base station, suspended freely from the ceiling (mast, plastic chain), may be sufficient.

CAUTION

The base station should not be installed on a reinforced concrete pillar because the pillar creates a partial shadow which means that a clear line of sight no longer exists.
In this case, two base stations must be installed 50 m to 75 m apart.

In the case of outer walls or interior siding and/or hall ceilings made of metal (or metal-clad), it may be necessary to increase the number of base stations and distribute them in such a way as to virtually exclude radio interference through reflections.

3.4.2 Outdoors

- Base station with outdoor housing (Figure 14)

  Only base stations with weather-resistant housing are suitable for radio coverage out of doors, e.g. on factory sites.

  – Installation

    A base station can be installed on a mast made of wood, plastic or concrete (not metal), on the roof of a building (preferably made of brick or light construction materials) or on the wall of a house.

  – The mast used must be stable and wind-resistant.

NOTE: Choose the installation site to allow maximum visibility from the base station to the service area.

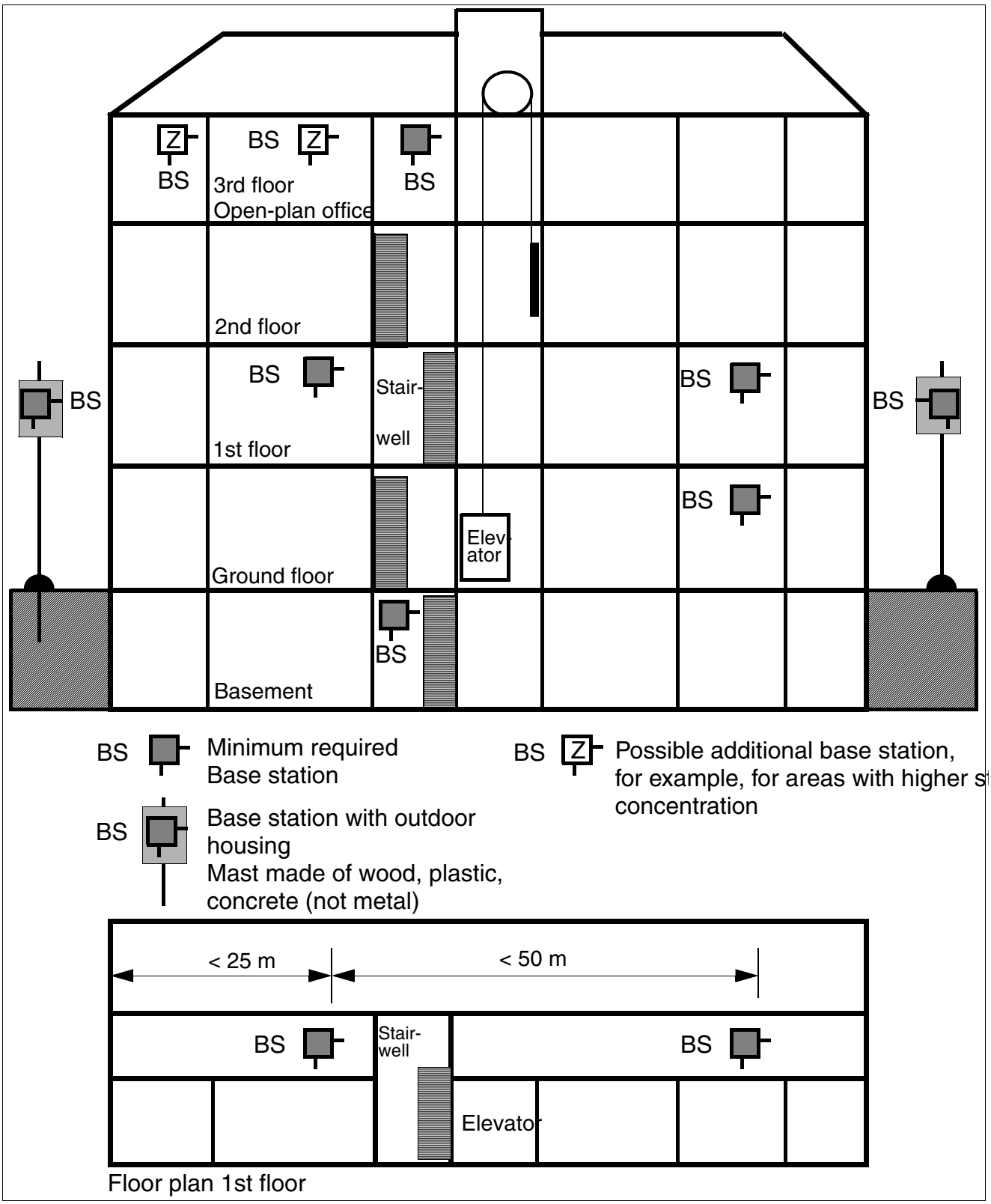


Figure 14 Base station distribution for base stations with housing for outdoor use

Example: Planning an outdoor area (Figure 15)

NOTE: A base station installed in an attic directly beside a dormer window (no metal reinforcement in the window pane) is the alternative to outdoor housing for coverage of the outdoor area.

- Planning

  A site plan, for example, with a scale of 1:300 or 1:1000 is helpful for determining the base station installation site.

  – The customer's preferred radio area should be indicated on the map (subject to customer confirmation).

  – Additional information about the types and heights of buildings is also helpful.

  – Radio coverage can be adequately determined with the aid of the site plan and the information above.

- Site plan, see Figure 15

  This plan depicts a company's grounds with buildings A to G. It includes the type of construction and heights of these buildings.

  – Bird's eye perspective
  It is relatively simple to find the point which offers the best possible view of the grounds without any obstructions.

  Placement around the buildings C, E, F, and G is not feasible since the view from these buildings extends only to a few neighboring buildings.

  The view from buildings A and B is better.

  In the example, the decision was made to place the base station at building B rather than A. Note that the areas between buildings C and E as well as F, G, and A are covered. The radio waves can pass through brick building A, so that an area of about 10 meters beyond will still be covered.

  In practice, coverage can also be assumed for other outdoor areas as waves pass through the windows.

- Reinforced concrete buildings or constructions with metal facades act as limiting factors. Areas behind these buildings are quasioptically blocked and must be considered not covered by the radio waves.

- Brick buildings
  can usually be penetrated so that significant parts of them are reached by the radio waves.
  The supply range, however, often stops less than 10 meters beyond these buildings.

- Streets
  act as conductors making greater ranges possible along them.

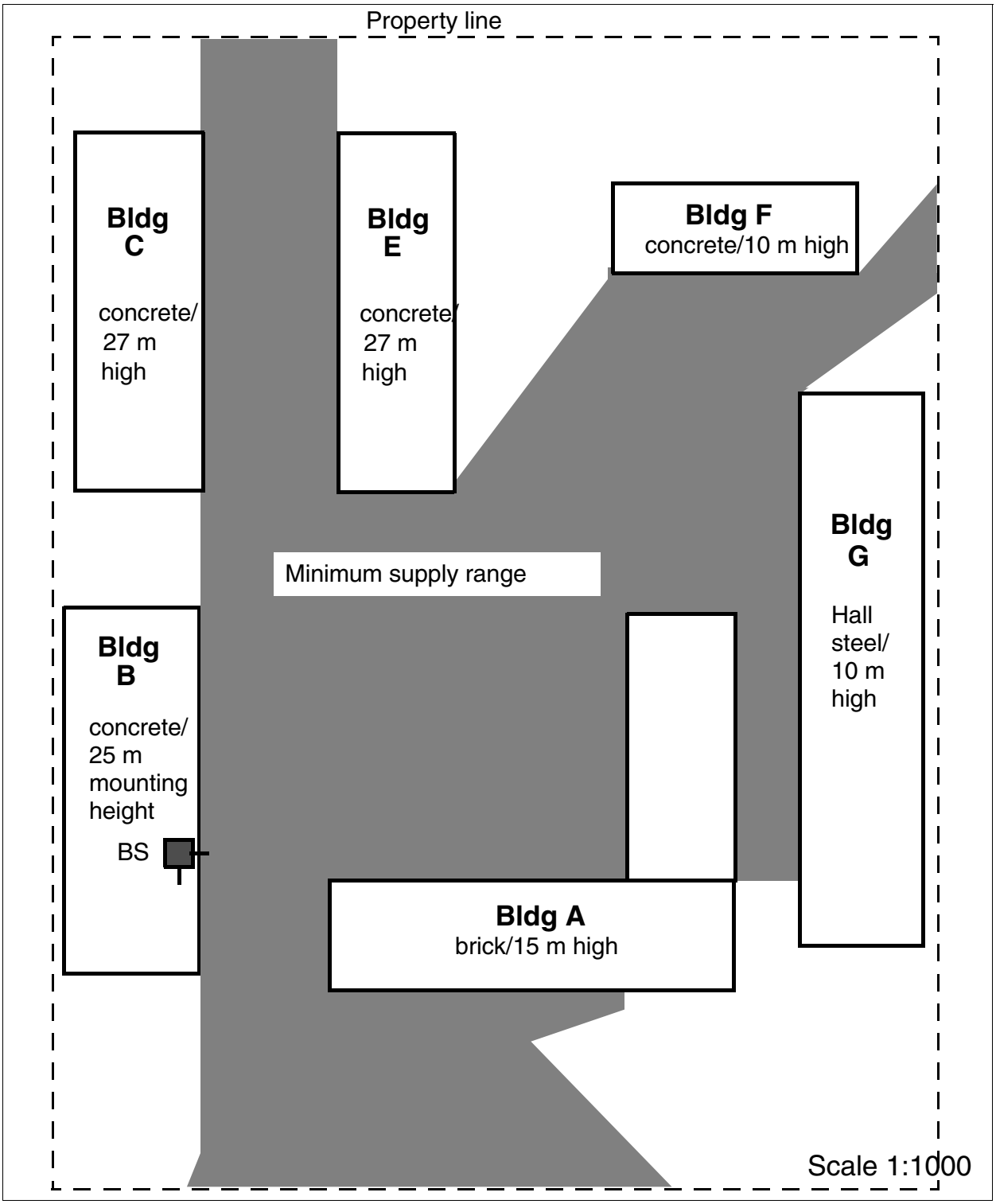


Figure 15 Base station distribution for coverage of an outdoor area

3.5 Installing Base Stations

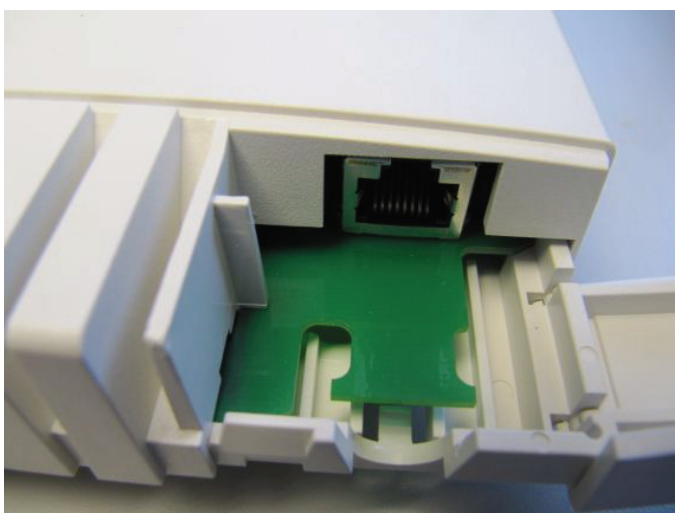
3.5.1 Ethernet Connection Cable

The DECT IP base stations are mounted using Ethernet cables that are terminated with an 8-pin shielded RJ45 connector. The feedthrough in the DECT IP base station's protective cover is 14 mm in diameter. Please take this dimension into account when choosing the RJ45 connector.

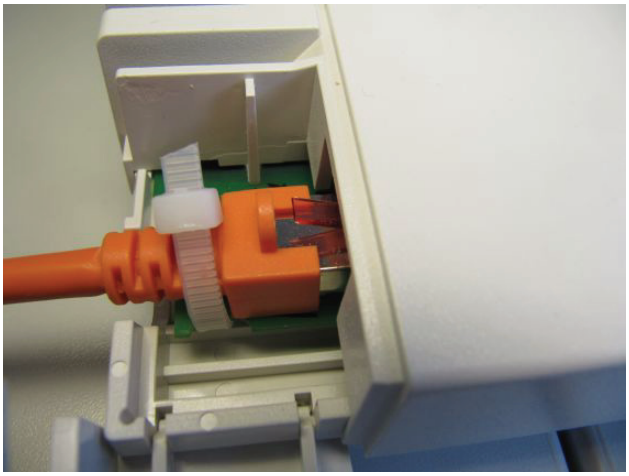
The connection cable inserted into the RJ45 jack must be secured additionally with a cable tie to ensure suitable strain relief:

Installation:

1. First loop the cable tie around the protrusion on the printed circuit board:



2. Then insert the cable through the loop into the RJ45 jack and tighten the cable tie around the notch on the printed circuited board and the connection cable :



3.5.2 Where Not To Install DECT IP base stations

CAUTION

Security zones
Areas designated by the customer as security zones, such as, intensive care units in hospitals or areas behind fire doors.

- **Ambient temperature/humidity**
  - Ambient temperature from +0°C to +40°C
    Avoid direct sunlight.
  - In damp places, such as bathrooms, laundry rooms, or in the immediate vicinity of heat sources (for example, heaters).
- **Radio area restriction**
  - In wall recesses or on thick or concrete and metal walls, if the radio supply area is behind them.
  - A base station mounted on a steel or concrete pillar cannot supply the radio area which lies behind the pillar.
- In lowered ceilings of metal (conductive materials, for example, carbon fibres).
- On metal walls
  Only if there is a safety distance of > 10 cm.

- On metal storage shelves
  Only if there is a safety distance of > 3 m.
- **Electromagnetic compatibility (EMC)**
  - The installation site should not be in the immediate vicinity of other electronic equipment, such as, regular (corded) telephones, hi-fi systems or office or microwave equipment. Only if there is a safety distance[1] of > 1 m.
  - Directly beside neon/phosphorous lighting tubes, fire alarms, switchgear cabinets, transformer housings, motor housings.
    Only if there is a safety distance[1] of > 1 m.
  - Directly beside antennas of other communication systems.
    Only if there is a safety distance[1] of > 3 m.

3.5.3 Where Should DECT IP base stations be installed?

- Freely accessible,
  - but near the ceiling (> 0.5 m away from the ceiling).
    (This prevents the base station being blocked by furniture.)
- As centrally as possible in buildings,
  - for example, in corridors or on walls of directly adjacent rooms (in the case of buildings of light construction materials).
- Outdoor areas

  may be part of the coverage area.

NOTE: When planning the installation of base stations in buildings (determining the installation site), architectural plans (scale of about 1:1000) which show the structural type of the building can be very helpful.

  - Near windows facing in the direction of the outdoor area to be covered.
  - Outdoor housing, see Section 3.5.6.

1. The safety distance isolates the installation from other equipment, thus improving the electromagnetic compatibility (EMC).

3.5.4 Indoors

3.5.4.1 Wall Mounting

The base station must be freely accessible.

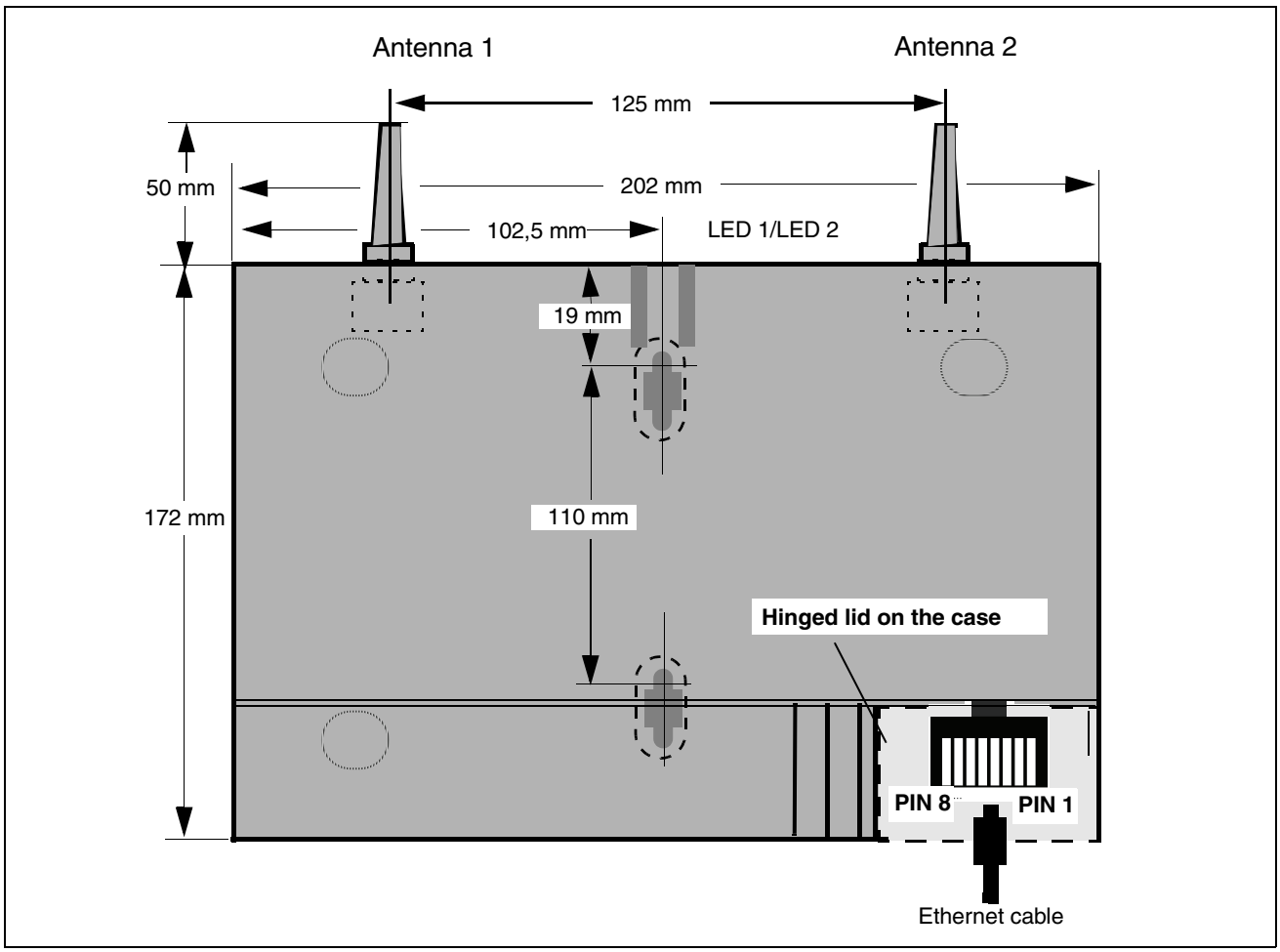
NOTE: When installing a DECT IP base station, the antennas should face downward.

– Antenna position	Antennas pointing towards open space, in direction of radio area
– DECT IP Base station mounting position	vertical/180° rotated
– Mounting	Mounting material not included in scope of supply

– Two wall anchors with 5 mm diameter, two screws with 3.5 mm diameter.

1. Drill two holes (5 mm diameter) 110 mm apart in the wall where the base station is to be mounted. Insert the wall anchors in the hole (see Figure 20).
2. Screw in the screws in such a manner that a clearance of about 4 mm remains between the head of the screw and the mounting wall. Different mounting material may be needed depending on the composition of the mounting wall, for example, wood screws for wooden walls.

   Alternative: You can use the housing feet openings in the base plate of the base station for mounting on wall hooks.
3. Mount the base station on the screw heads or wall hooks.



3.5.4.2 Ethernet Socket Allocation in the DECT IP Base Station

PIN	Signal MDI	Signal MDI-X
1	Tx+ (V+)	Rx+ (V-)
2	Tx- (V+)	Rx- (V-)
3	Rx+ (V-)	Tx+ (V+)
4	V+	V+
5	V+	V+
6	Rx- (V-)	Tx- (V+)
7	V-	V-
8	V-	V-

Table 6 pin assignment of the Ethernet socket

3.5.5 Tools/Aids

The tools and aids listed below will be required when carrying out the activities described in the following sections. However, they are not included in the delivery scope.

Table 7 Tools/aids

Designation	**Application**
Crosstip screwdriver size 3	To attach installation plate, sun shield
Crosstip screwdriver size 2	To attach mast blocks/mast installation of outdoor housing
Triangle head screwdriver M 6	To attach and close the housing/outdoors
Aids	
Masonry drill, 8 mm diameter	To drill holes for wall installation, housing/outdoors
Masonry drill, 5 mm diameter	To drill holes for wall installation, housing/indoors

3.5.6 Outdoors

NOTE: The base station contains an overvoltage protector.

- Features of the outdoor housing
  - No special grounding necessary.
    The outdoor housing is made of 100% plastic.
  - Cable feeder entry.
  - Protection against direct sunlight.
  - Base station protection at ambient temperature between -25°C and +40°C (can be operated without heating, +sunlight).
- Figure 16 shows the components of the outdoor housing.
  - The outdoor housing is supplied preinstalled.
  - The necessary installation material is supplied loose.
  - Install the outdoor housing on a mast or on masonry/wood/brick walls.
  - Connect the cable from the communication system (see Section 3.5.4.2).

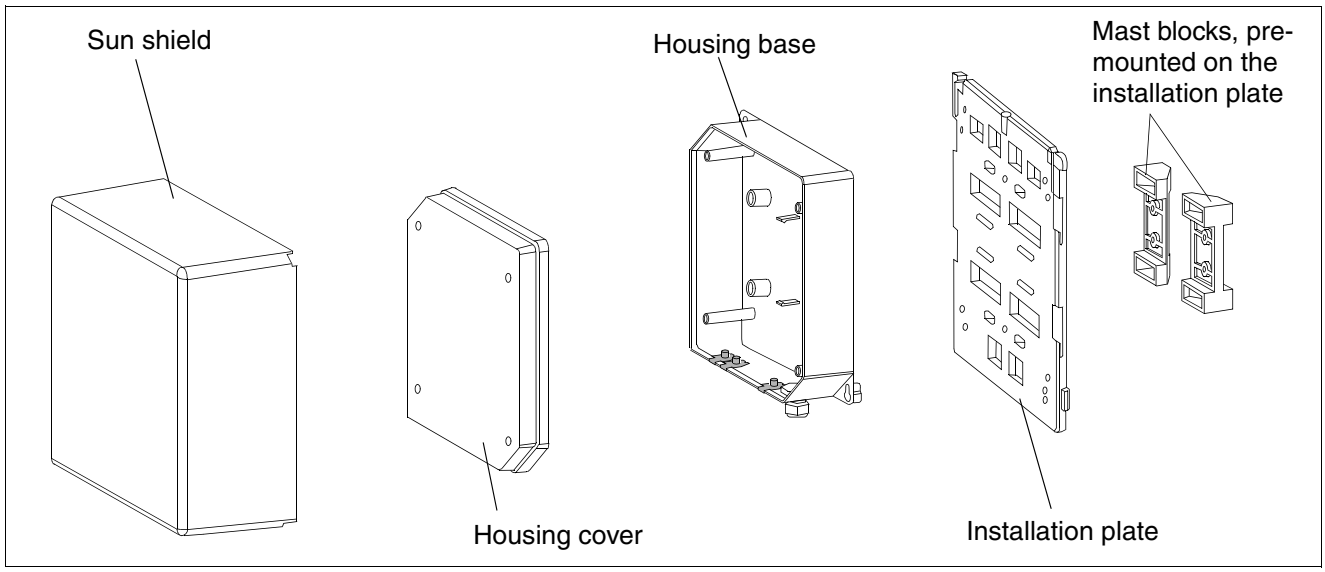


Figure 16 Components for outdoor installation

3.5.6.1 Preparatory Tasks

The following tasks must be performed with appropriate tools before installing the outdoor housing:

1. Release the sun shield catches and remove the sun shield.
2. Loosen the special screws that connect the base of the outdoor housing to the mounting plate and remove the outdoor housing.
3. Open the outdoor housing (four M6 triangle head bolts in the cover).
4. Remove the hinged lid to connection plug X1.
5. Install the base station in the recess provided for this purpose making sure it locks into place (listen for the latching noise).

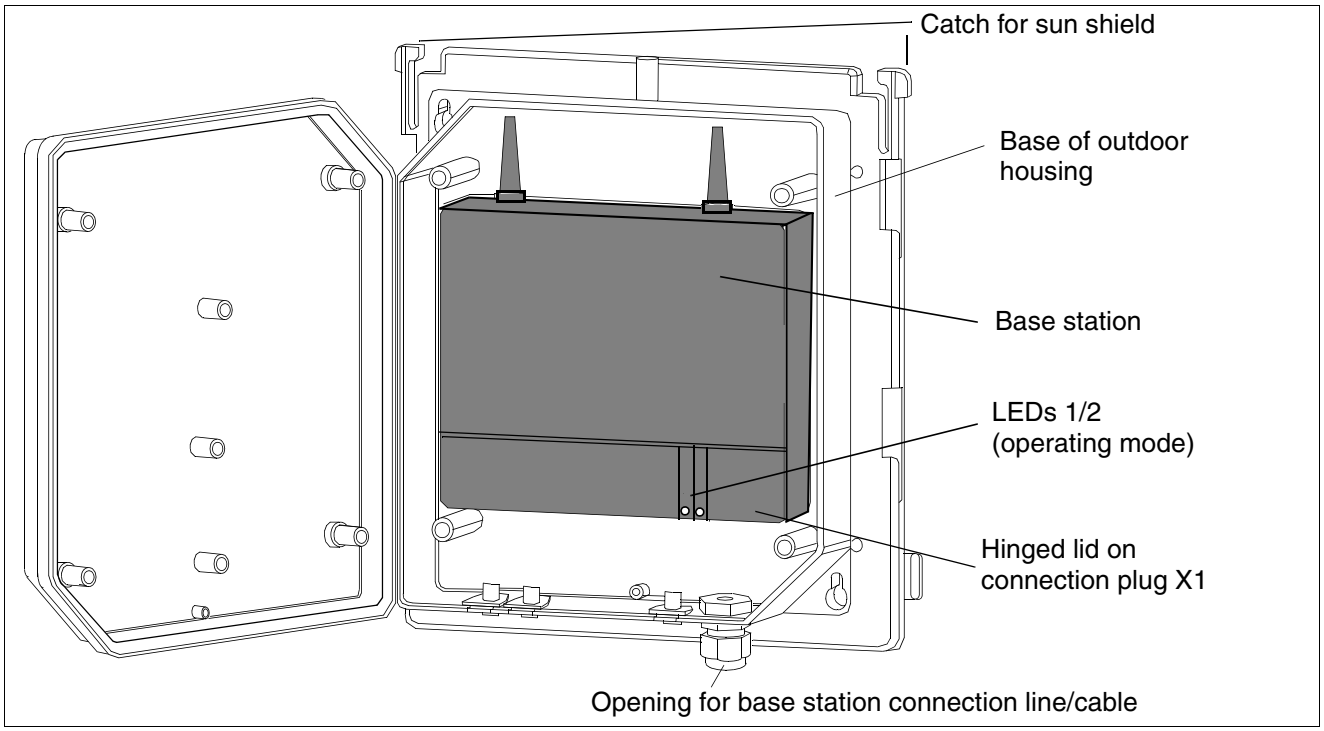

Catch for sun shield
Base of outdoor housing
Base station
LEDs 1/2 (operating mode)
Hinged lid on connection plug X1
Opening for base station connection line/cable

Figure 17 Outdoor housing with base station

3.5.6.2 Mast Installation

Material required (supplied loose): two metal tightening straps.

1. Loosen the mast block fastening screws.
2. Set the distance of the mast blocks to the necessary mast diameter at the required height and tighten the screws.
3. Feed the metal tightening straps through the specially-provided holes in the installation plate, see Figure 18.
4. Attach the base of the outdoor housing to the triangle head bolts on the installation plate.
5. Screw the triangle head bolts tight.
6. If necessary:
   Thread a sealing wire through the lower right fastening hole on the base and the sealing hole on the mounting plate, see Figure 18.
   Seal the wire.

7. Attach the installation plate to the mast at the required height with the metal tightening straps. The mast used must be stable and wind-resistant.

CAUTION

Do not install the base station on steel masts.

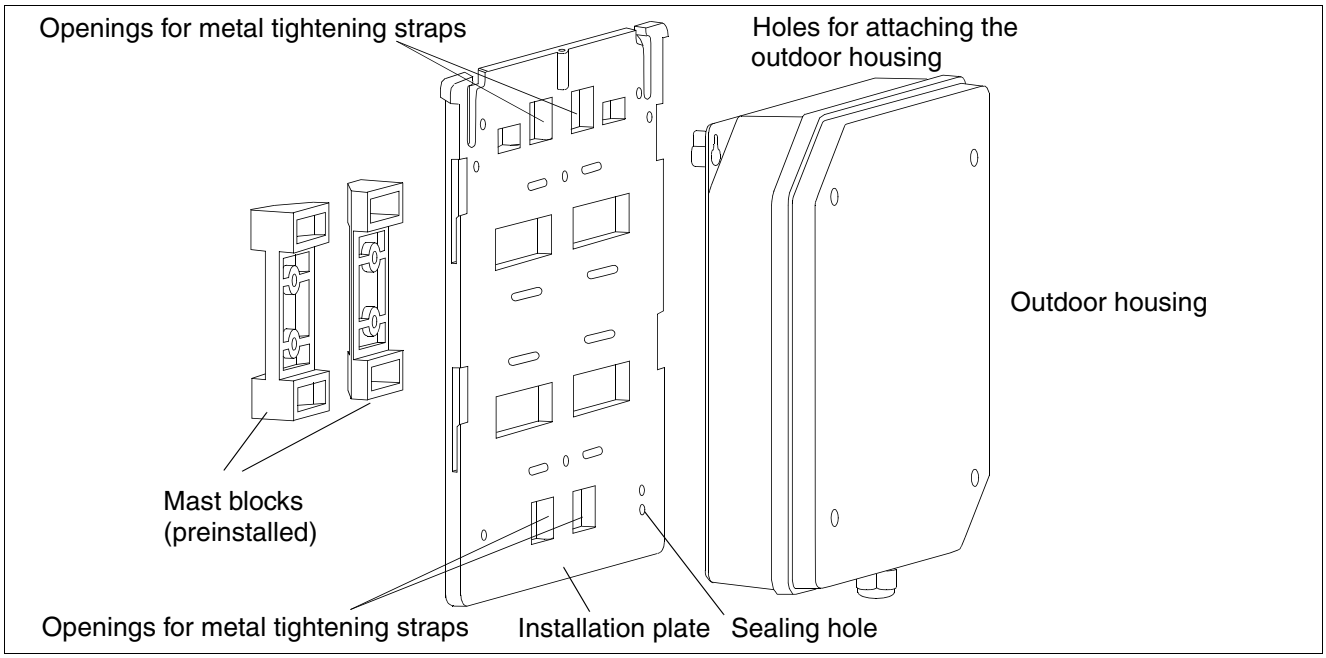


Figure 18 Outdoor housing with mounting plate and mast blocks

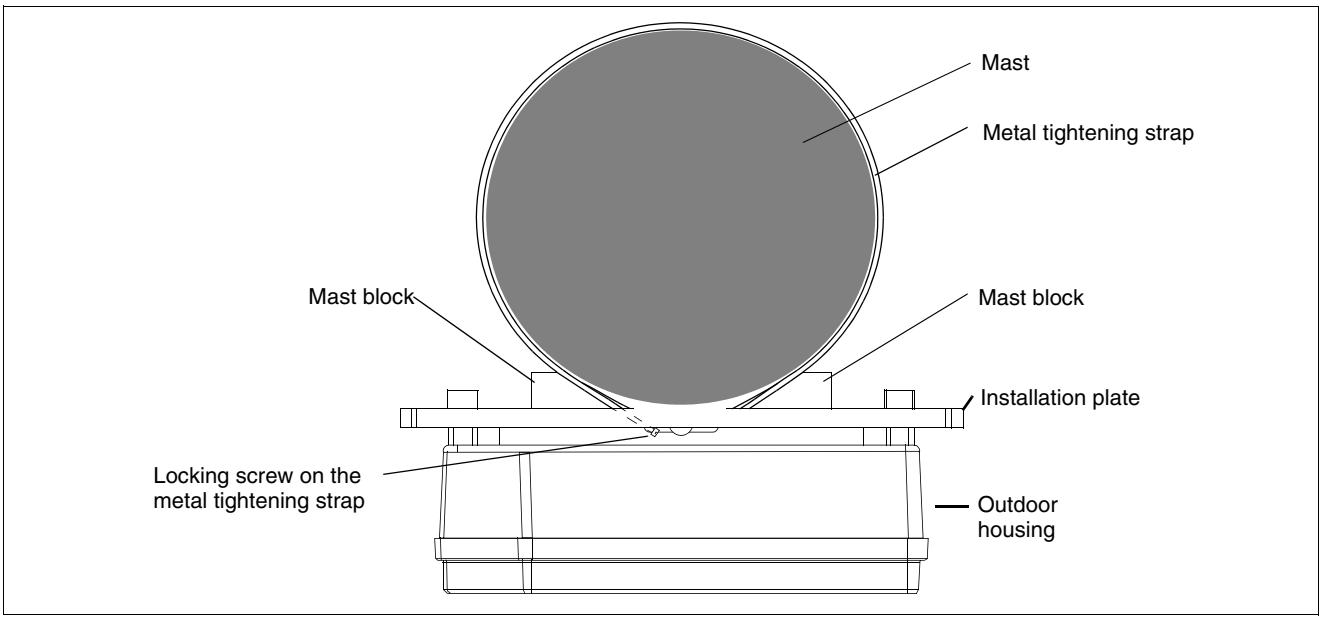


Figure 19 Mast installation – plan view

8. Connect the base station connection cable(s) (see Section 3.5.4.2).
9. Secure the housing cover with the four triangle head bolts.
10. If necessary: lock the sun shield into the spaces on the sides of the installation plate.

3.5.6.3 Wall Installation with Mounting Plate

Material required:

– Two wall anchors of 8 mm diameter, two screws of 6 mm diameter.

NOTE: Different mounting material may be needed depending on the composition of the mounting wall, for example, wood screws for wooden walls.
In such cases, change/purchase the appropriate mounting material.

---

1. Drill two holes (8 mm diameter) in the wall where the base station is to be mounted.
   For dimensions, see Figure 20.
   – Ensure that there is enough room for the mounting plate.
   – Insert the wall anchors in the holes.
2. Remove the mast blocks from the mounting plate.

3. Attach the mounting plate to the wall with the two screws.
4. Attach the base plate of the outdoor housing to the triangle head bolts on the mounting plate.
5. Screw the triangle head bolts tight.
6. If necessary:
   Thread a sealing wire through the lower right fastening hole on the base and the sealing hole on the installation plate and seal it (see Figure 18).
7. Connect the base station connection cable(s) (see Section 3.5.4.2).
8. Secure the housing cover with the four triangle head bolts.
9. If necessary: lock the sun shield into the spaces on the sides of the installation plate.

3.5.6.4 Wall Mounting Without Mounting Plate

Material required: two wall anchors of 8 mm diameter

1. Drill two holes (8 mm diameter) in the wall where the base station is to be mounted.
   For dimensions, see Figure 20. Insert the wall anchors in the holes.
2. Screw the two triangle head bolts through the mounting plate and into the wall anchor so that a clearance of about 12 mm remains between the screw head and the mounting wall.
3. Hang the base plate of the outdoor housing into the screws by its tabs (upper left and lower right) and tighten the screws.
4. Connect the base station connection cable(s) (see Section 3.5.4.2).
5. Secure the housing cover with the four triangle head bolts.

NOTE: The sun shield cannot be mounted without the mounting plate.

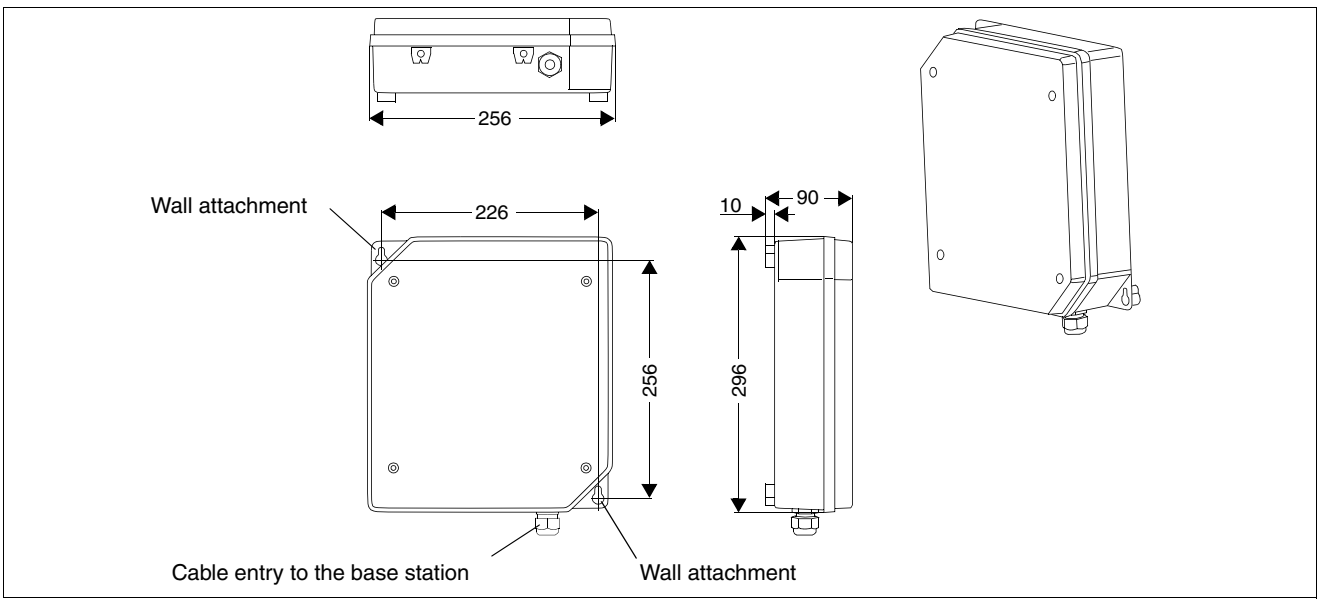


Figure 20 Wall mounting without mounting plate

4 Putting Into Service

You can only put your HiPath Cordless IP system into operation after the

- planning,
- coverage,
- installation and cabling,
- installing the communication server and if necessary, the HiPath Cordless IP server.

requirements have been fulfilled. The installation of the HiPath Cordless IP system now starts.

4.1 Preparation

1. DECT handsets are charged.
2. DECT system ID is available.
3. LAN suitability for VoIP services is analyzed (refer to Section 3.3).
4. Administration access is available for the HiPath Cordless IP server software's Web-Based Management application.
5. Information is available on subscribers, stations numbers, names.
6. There is a sufficiently large number of IP addresses available for use for the HiPath Cordless IP server software and the DECT IP base stations.
7. The IP address of the communication server, the DHCP server and the DNS server is determined.
8. The customer data available is backed up.

Optional if these services are to be used:

9. The PoE injectors are available.

4.2 Entering the DECT System Number (DECT ARI)

The DECT system number consists of eight hexadecimal characters and is unique worldwide for each DECT system.

The DECT system number is the number used to identify the individual DECT systems and therefore to identify the radio signals (radio range). This permits the synchronization of mobile telephones logged on to the system.

The DECT system number consists of:

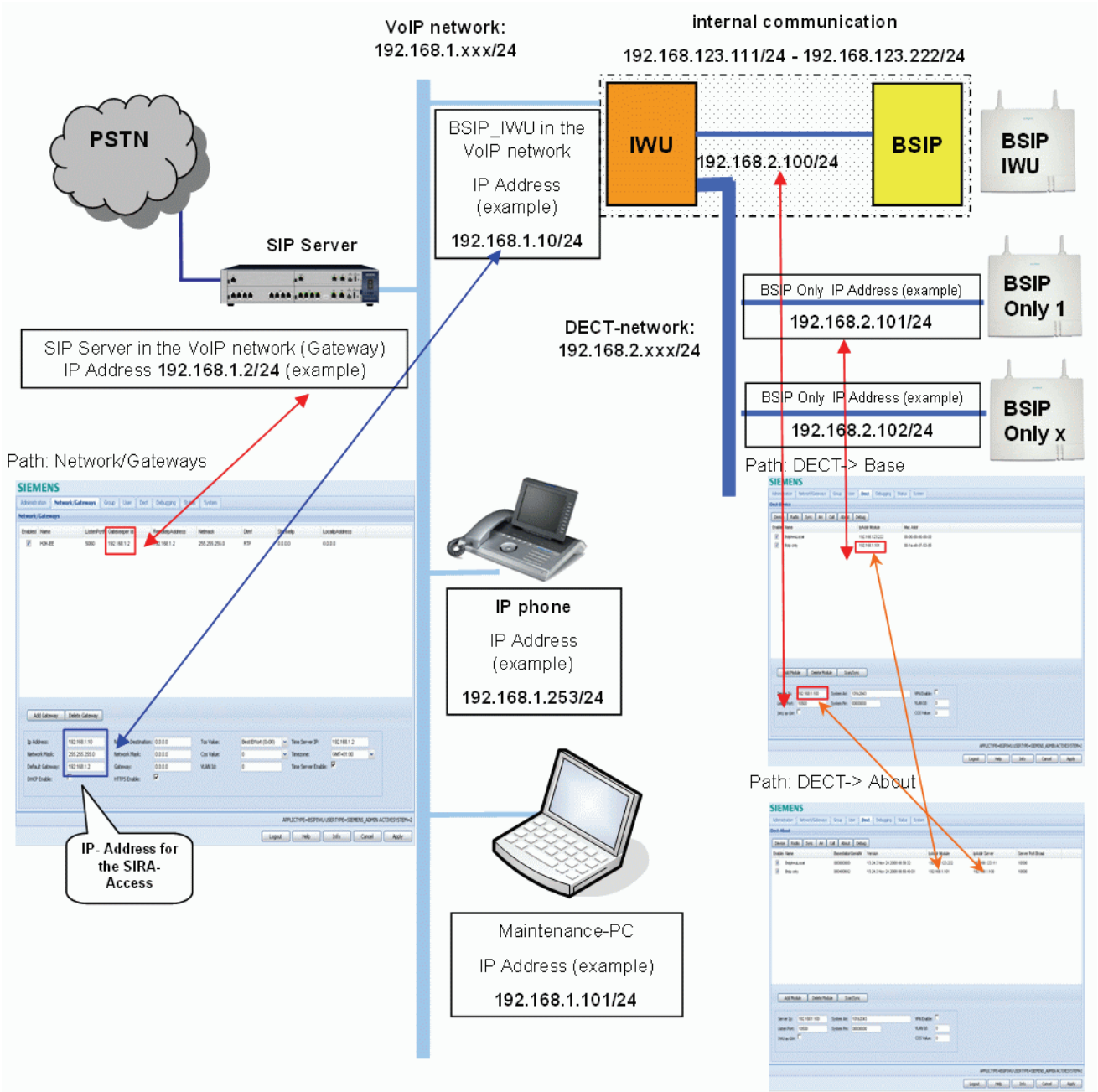
- E/ARC (Access Right Code, 4-bit (first digit is always 1)
- EIC (Equipment Installers Code, 16-bit),
- FPN (Fixed Part Number, 8-bit), and
- FPS (Fixed Part Subnumber, 4-bit).

When installing the system for the first time, you must apply for the DECT system number which then applies to the entire HiPath Cordless IP server software (even in the event of service).

The DECT system number is stored in the HiPath Cordless IP server software database.

This system number should be stored safely (loss).

4.3 Overview IP adresses



5 Installation and Administration

The installation and administration of both platforms of the HiPath Cordless IP System are described in the Administration Manual.

The both platforms are:

- HPCIP - Small Solution: The HiPath Cordless IP Server Software (HPCIP-IWU*) is running on a BSIP (BSIP-IWU).
- HPCIP - Server Solution: The HiPath Cordless IP Server Software (HPCIP-IWU) is running on a dedicated Server “FSC Tx150 S7” (Server-IWU).

6 Technical Data

6.1 BSIP1 DECT standard EU

• Number of channels	120 duplex channels, freely administered (10 carriers, each with 12 time-division multiplex channels)
• Frequency range	1.88 to 1.9 GHz (send and receive range)
• Channel spacing	1.728 MHz
• Bit rate	1.152 Mbps
• Speech encoding	32 kilobit ADPCM
• GAP standard	Specified in DECT specification 300444
• PN CAP	Siemens-specific protocol enhancement
• DECT Access	EN 301 406 V.1.5.1

SIEMENS

Siemens Enterprise Communications GmbH & Co. KG

DECLARATION OF CONFORMITY

We declare that the product

HiPath Cordless Basestation IP (BSIP1)
including the option: Outdoor Box

(name, type, model or version)

conforms to the following European Directives and European standards:

conformity in accordance with ISO/IEC 17050

Directive 99/5/EEC: Radio and Telecommunication Terminal Equipment

EN 60950-1:2006 +A11:2009 +A1:2010 +A12:2011	Safety - Information technology equipment -
EN 60950-22:2006	Part 22: Equipment installed outdoors
EN 50385:2002	EMF, Basic restriction Human Exposure for radio base station
EN 55022:2006+A1:2007 ClassB	EMC, Emission ITE Residential Environment
EN 61000-6-2:2005	EMC, Immunity in industrial area
EN 301 406 V2.1.1	DECT covering the essential requirements under article 3.2 of the R&TTE Directive; Generic radio
EN 301 489-1 V1.8.1	ERM & EMC standard for radio equipment Part 1: Common technical requirements
EN 301 489-6 V1.3.1	ERM & EMC standard for radio equipment Part 6: Specific conditions for DECT equipment

Munich, February 7th, 2012
(Place and date of issue)

i.V.
(Uwe Montag – Senior Vice President for LC)
(Name, Function and signature of authorized person)

i.V.
(Richard Wendl – Head of development HP4k)
(Name, Function and signature of authorized person)

Richard Wendl

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General Partner: Siemens Enterprise Communications Management GmbH
Managing Directors: Alexander Frick, Thomas Heim, Martin Kinne, Vera Meyer; Chairman of the Supervisory Board: Mark Stone;
Registered offices: Munich; Commercial registry: Munich, HRB 163415

Number of Declaration: 12 / 002

6.2 BSIP1US DECT standard USA

- This device complies with Part 15 of the FCC rules and with RSS-210 of Industry Canada.
- Operation is subject to the following two conditions:
  1. this device may not cause harmful interference, and
  2. this device must accept any interference received, including interference that may cause undesired operation.
  3. Changes or modifications made to this equipment not expressly approved by (manufacturer name) may void the FCC authorization to operate this equipment.
- This device is tested and fulfills the Radio Standards Specification RSS-213 Issue 2.
- This device complies with FCC Part 15 Subpart D, unlicensed personal communication devices.
- Frequency band: 1920-1930 MHz.
- Type of Modulation: multi carrier time division multiple access with Digital modulation (GFSK).
- Number of channels: 5 RF Channels, 5x12=60TDMA Duplex channels.
- Antenna information: 2 permanent attached antennas, no external connector.
- RF Power: max. +20,5dBm.
- Temperature range: -10 to +45 degree Celsius (ambient).
- FCC ID: AY3-BSIP1US.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

6.3 Base Stations

General

• Software	Can be loaded via the communication system.
• Antennas	Two external antennas are mounted on the top of the housing of the base station. The base station works as option with antenna diversity (this means that the radio receiver is connected to whichever antenna delivers the greater field strength).
• Average output power	10 mW to 125 mW
• Radio range	Basically dependant on the radio transmission characteristics of the environment/premises.
– Outdoors	Up to 300 m
– Indoors	Up to 50 m
• Power supply	PoE is used to supply power to the DECT IP base station
• Accessories	Outdoor housing

DECT IP Basisstation BSIP1

• Dimensions	202 x 172 x 43 (W x H x D in mm)
• Weight	500 g
• Power supply	PoE, according IEEE 802.3af Class 2
• Power consumption	< 6,5 W
• Operating temperature indoors Outdoors (in outdoor housing)	+ 0°C to + 40°C - 25°C to + 40°C
• Cabling	10/100 Mbps Ethernet cable, Cat. 5 and higher, 8-pin shielded RJ45 connector

LED status displays on the base station

- No settings need be made at the base station.
- LED 1/LED 2 on the front of the base station provides the following information:

Operating State	LED 1		LED 2	
LED status at booting sequence				
No power on Base station	off		off	
BSIP1 is booting the the Active partition	red flashing		red flashing	
BSIP1 is booting the the Fallback partition	red flashing		off	
BSIP1 is booting the Active partition with factory defaults	red fast flashing		red fast flashing	
BSIP1 is booting the Fallback partition with factory defaults	red fast flashing		off	
BSIP1 is booting kernel with Active partition	off		red	
BSIP1 is booting kernel with Fallback partition	red		off	
LED status at working process				
BSIP1 not ready Services not started or starting	orange		orange	
BSIP1 ready No LAN link	red		red	
BSIP1 ready No Connection to IWU	green		red	
BSIP1 ready All DECT-frequencies blocked or all available DECT channels occupied	red		green	
BSIP1 ready Link unsynchronized (DECT/LAN), no active call	off		green	

Table 8 LED status displays on the base station

Operating State	LED 1		LED 2	
BSIP1 ready Link unsynchronized (DECT/LAN), at least one active call *	off		green flashing	
BSIP1 ready Link synchronized (DECT/LAN), no active call	green		green	
BSIP1 ready Link synchronized (DECT/LAN), at least one active call	green		green flashing	

Table 8 LED status displays on the base station

* On BSIP IWU means this LED status that a call might by located at another BSIP and be routed via the BSIP IWU

Blinking frequency = 500 msec. ON, 500 msec. OFF

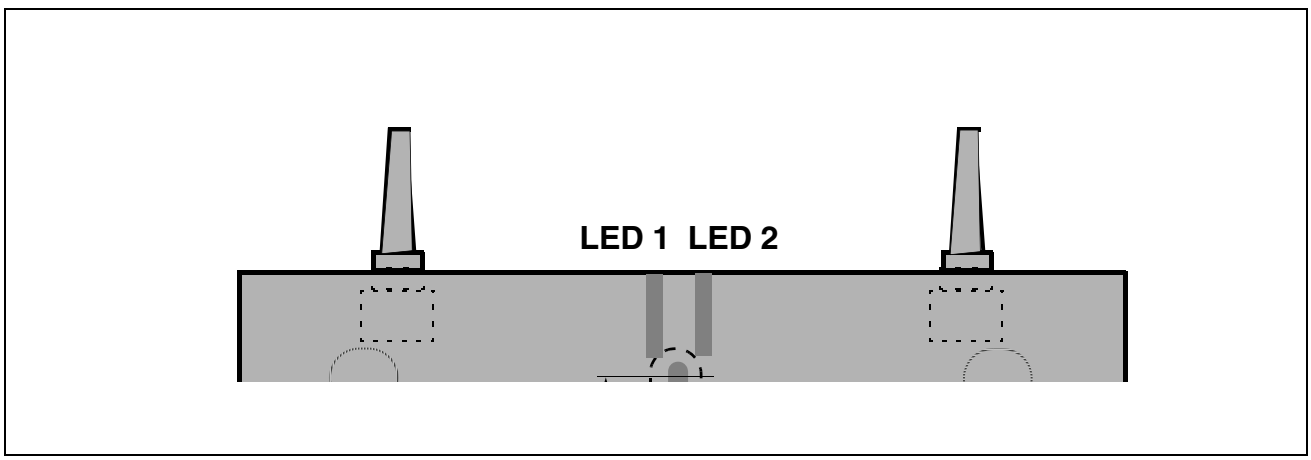


Figure 21 LED position on the base station

6.3.1 HiPath Cordless IP server

- FSC server with special HW-optimized Linux operating system (openWRT),
- Server is included in the scope of the solution (not a standard server).

Model	Fujitsu-Siemens, Floorstand, incl. 3.5" FD
Processor	Xeon UP X3220 2.40GHz 2x4MB 1066MHz Quad Core CPU with cooling element (95W) 2x4MB SLC ECC protected, 1066MHz FSB 64-bit/Intel® VT
RAM	1GB DDR2-800 PC2-6400 ub d ECC 1 module 1GB, unbuffered dual rank DDR2 8 no Chipkill
DVD drive	DVD-ROM 1.6" SATA 16x DVD, 48x CD 1.6" anthracite
Hard disk	HD SATA 3GB/s 250 GB 7.2k hot plug 3.5"
Miscellaneous	KBPC SX D standard keyboard global design bright light gray keyboard 2m PS2 Cable Mains supply line (D,..), 1.8 m, gray suitable for D, A, B, F, NL, FIN, N, E, P, RUS, TR
Optional available	Conversion kit for switching HiPath Cordless IP servers into 19-inch models (5 U)

Table 9 HiPath Cordless IP server

6.3.2 PoE Injector

- An injector is needed when operating the DECT IP base station on the mains,
- Single-port PoE injector in compliance with IEEE 802.3af Class 2
- Injector is included in the scope of features
- The PoE injector ships with startup information and notes on LED status displays.

6.4 Item Number Overview

- Base stations
  - HiPath Cordless IP V1 - Base station BSIP1 — S30807-U5494-X
  - HiPath Cordless IP V1 - SW License per HiPath Cordless IP Server* — F31505-K111-A2
  - HiPath Cordless IP V1 - SW License per DECT IP Basisstation BSIP1* — F31505-K111-A1
  - HiPath Cordless IP V1 - CD-ROM with software — P30152-P1440-P1
  - DECT system number (ARI = Access Right Identifier) — A31003-G2121-S500-*-20
  - HiPath Cordless IP V1 - HiPath Cordless IP Server — CUZ:1265V101-SEN04 (to be ordered at Fujitsu)
  - One-Port PoE Injector — S30122-X8009-X20
  - Outdoor mounting — S30122-X7469-X2
  - Power line for PoE injector - EU — C39195-Z7001-C11
  - Power line for PoE injector - UK — C39195-Z7001-C20
  - Power line for PoE injector - Switzerland — C39195-Z7001-C38

  *only needed if the HiPath Cordless IP server software is installed on dedicated server hardware and not on one of the DECT IP base stations
- Terminals
  - **Gigaset M2 professional** — S30852-S1756-R111
  - Charging unit for EU including plug-in power supply unit — S30852-H1786-R101
  - Charging unit for UK including plug-in power supply unit — S30852-H1786-L101
  - **Gigaset M2 EX professional** — S30852-S1756-R121
  - Charging unit for EU including plug-in power supply unit — S30852-H1786-R101
  - Charging unit for UKincluding plug-in power supply unit — S30852-H1786-L101
  - **Gigaset M2 *plus* professional** — S30852-S1756-R131
  - Charging unit for EU including plug-in power supply unit — S30852-H1786-R101
  - Charging unit for UK including plug-in power supply unit — S30852-H1786-L101
  - **Gigaset S3 professional** — S30852-H1950-R142
  - Charging unit for EU including plug-in power supply unit — S30852-H1980-R142
  - Charging unit for UK including plug-in power supply unit — S30852-H1980-L142
  - Charging unit for US including plug-in power supply unit — S30852-H1980-R342
  - Charging unit for AUS including plug-in power supply unit — S30852-H1980-C442
  - **Gigaset SL3 professional** — S30852-H1952-R142
  - Charging unit for EU including plug-in power supply unit — S30852-H1982-R141
  - Charging unit for UK including plug-in power supply unit — S30852-H1982-L141
  - Charging unit for US including plug-in power supply unit — S30852-H1982-U141

– Charging unit for AUS including plug-in power supply unit	S30852-H1982-C441
– Gigaset S4 professional	S30852-H2156-R141
– Charging unit for EU including plug-in power supply unit	S30852-H2181-R142
– Charging unit for UK including plug-in power supply unit	S30852-H2181-L142
– Charging unit for AUS including plug-in power supply unit	S30852-H2181-C442
– OpenStage SL4 professional	S30852-H2352-R141
– OpenStage SL4 professional LAM	S30852-H2352-U141
– Charging unit for EU including plug-in power supply unit	S30852-H2382-R141
– Charging unit for UK including plug-in power supply unit	S30852-H2382-L141
– Charging unit for AUS including plug-in power supply unit	S30852-H2382-C441
– Charging unit for BRA including plug-in power supply unit	S30852-H2382-U341
– Charging unit for US including plug-in power supply unit	S30852-H2382-U141

*

6.5 Measuring Equipment

• HiPath Cordless Servicetool HCS DECT Locater / Locater Pro	TIS Technische Informations-Systeme GmbH Barloer Weg 190 46397 Bocholt, Germany Tel.: (0 28 71) 27 22 - 0, (0 28 71) 3 78 62 http://www.tis-gmbh.de/produkte/

6.6 Operating Manuals

See http://apps.g-dms.com:8081/techdoc/search_en.htm

7 Diagnosis and Maintenance

7.1 Checking the Base Stations and the Radio Coverage

Do not use Gigaset mobile telephones to check the radio area coverage. This must be done with the Hicom Cordless Service tool (HCS-DECT).

You can use Gigaset mobile telephones to test the base stations and verify the radio area coverage.

- A prerequisite is that the mobile telephone being used is logged on to the system, see the operating manual.
- The radio coverage is tested in two stages:
  - Base station test
  - Coverage test via the base stations (area coverage)

  The following minimum values must be observed for the site survey of the radio range:

  1. Providing handsets with an adequate DECT radio signal

     Handsets only receive a sufficiently sized DECT radio signal if they are located in the radio range of the DECT IP base station, that is:

     - RSSI value <-70 dBm
     - FRAQ value >95%

  2. Distance of DECT IP base stations

     For the DECT synchronism function to work, the DECT IP base stations to be synchronized with each other must be defined in the HiPath Cordless IP server software. These DECT IP base stations must also be able to exchange their management information, i.e. they must be at least <-85 dBm apart.

     Failure to maintain these values results in a loss of radio signal or a loss of synchronism which prevents the handsets from roaming to another DECT IP base station.

7.1.1 Base Stations

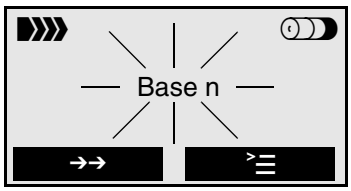
The purpose of this test is to check the functions of all base stations.

- Take the mobile telephone to each of the base stations.
- Holding the mobile telephone directly below, beside or above each base station, turn it off and on again.
  - Display data, for example:

Synchronization between mobile telephone and base station

Radio connection to the base station is displayed on the screen as "Base n", for example.

No synchronization between mobile telephone and base station



"Base n" flashes, it means that the radio connection to the base station has been lost.

- Set the mobile telephone to measuring mode.

NOTE: Values recorded with a mobile telephone are not very precise and are intended to provide a rough assessment only. In addition, different values may be recorded on each mobile telephone even though the ambient conditions are identical. If you require more accurate results, we recommended that you use the Hicom Cordless Service tool (HCS-DECT).

Check:

- **RSSI value** (field strength value)
- **RPN value** (base station number)
  Does the mobile telephone pick up the connection (synchronization) with the base station to be tested?
- **FRAQ value** (transmission quality %)

If the indicated values are not attained, use a second logged-on mobile telephone to check the value ranges.
If the indicated values are not attained with the second mobile telephone, replace the base station.

WARNING

The customer must be informed about the boundaries of the radio area.

Proceed with the area coverage test once the RSSI value, the availability and radio quality of all base stations has been checked.

7.1.2 Quick Verification of Area Coverage

The purpose of this test is to check whether the necessary field strength and the transmission quality is attained throughout the entire radio network.

NOTE: Values recorded with a mobile telephone are not very precise and are intended to provide a rough assessment only. In addition, different values may be recorded on each mobile telephone even though the ambient conditions are identical. If you require more accurate results, we recommended that you use the Hicom Cordless Service tool (HCS-DECT).

Step 1

The purpose of this step is to provide the basis for step 2 where you will use a Gigaset mobile telephone to obtain a rough assessment of the area coverage.

- Switch the mobile telephone to measuring mode (see Section 7.2.2.1).
- Establish a voice connection between two mobile telephones. If you wish, you can use an announcement service (for example "speaking clock").

Step 2

This step involves obtaining a rough assessment of the area coverage.

- With a mobile telephone in measuring mode, move around the area in question and determine whether an RSSI value > 50 (-60 dBm) and a FRAQ value > 95% are reached throughout the area.
  In the process, the Range Warning feature can be used as an aid for recognizing the radio area boundaries. A warning tone (range warning) is

emitted as soon as you cross the border zone of the radio area. (To activate the range warning tone, use the "Tones" menu on the mobile telephone display.)

WARNING

Areas in the corners of buildings or behind metal structures should be carefully checked (check the RSSI values several times).

In these radio area border zones, the radio connection to the base station may be lost in the case of the following values:

RSSI	< 40 (< -80 dBm)
FRAQ	< 95%

- The measuring sites with RSSI value < 40 (< -80 dBm) should be entered or marked in the building/site plan.

Step 3

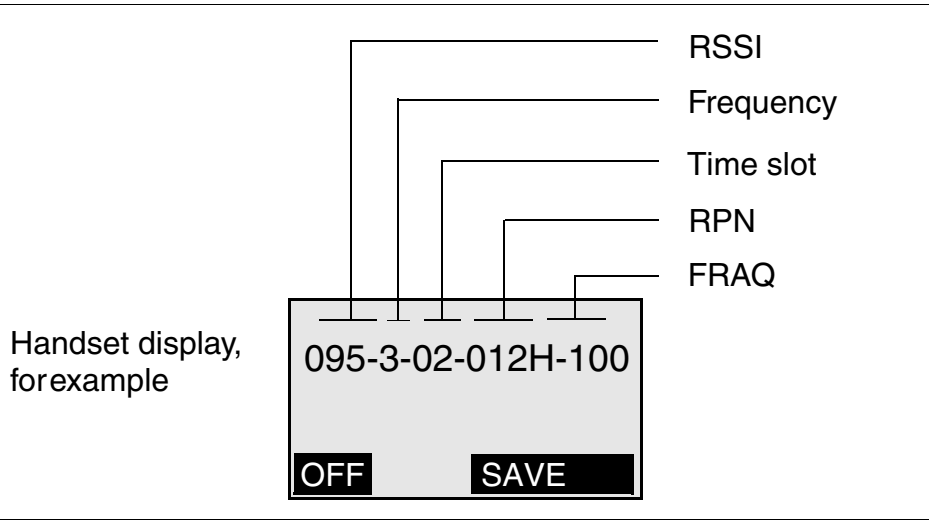
If you require more accurate values than those obtained in step 2, we recommended that you use the Hicom Cordless Service tool (HCS-DECT).

7.2 Testing the Radio Area

7.2.1 Significance of Results Obtained

NOTE: Values recorded with a mobile telephone are not very precise and are intended to provide a rough assessment only. In addition, different values may be recorded on each mobile telephone even though the ambient conditions are identical. If you require more accurate results, we recommended that you use the Hicom Cordless Service tool (HCS-DECT)

The following figure shows a sample display of the measuring results for a Gigaset mobile telephone when a call is in progress:



Measurement result

RSSI (radio signal)	Field strength of the radio signals received from the base station, normalized to a maximum of 100. If the value is < 50, the radio connection to the base station is no longer guaranteed. Acceptable field strength is > 50 (> -60 dBm).
Frequency	Frequency (0 – 9)
Time slot (Slot)	Time slot (0 – 11) of the receiving channel on which the measurement is carried out.
RPN (port number)	IDECT IP base station identification based on the RPN (Radio Fixed Part Number), e.g. 018. If the handset switches on at/over to an overlapping radio cell/DECT IP base station, the current DECT IP base station appears on the handset display. The RPN is indicated in hex format in Gigaset S3 professional and Gigaset SL3 professional handsets. Example: RPN 018 will be display in the Gigasets as HEX-value 012H. The identifier "H" shows clearly the hexadecimal presentation.
FRAQ (frame quality)	Transmission quality in %. 95% to 100% satisfactory (for short periods 90% to 94% non-critical), < 95% faulty.

7.2.2 Gigaset Family

NOTE: The default language for measuring mode is English.

7.2.2.1 Activating Measuring Mode

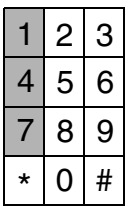
You must switch off the mobile telephone before you can activate measuring mode.

Switch off the mobile telephone:

Press the on-hook key until the confirmation beep is heard (ascending tone sequence).

Nothing is displayed

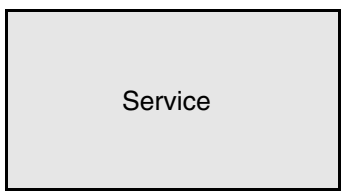
Switch the mobile telephone into service status:



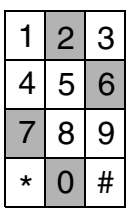
Press keys 1, 4, and 7 simultaneously...

... whilst at the same time...

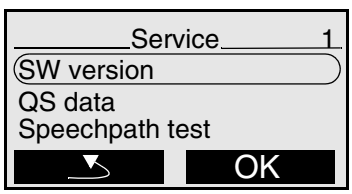
... pressing the on-hook key.



Activate the "Service" menu:



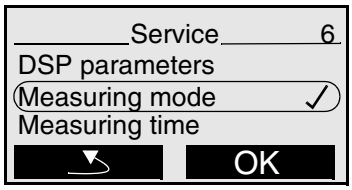
Enter code 76200.



Activate the measuring mode:

OK

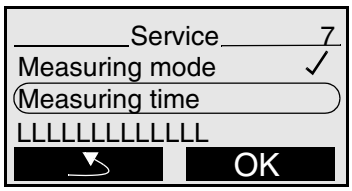
Using the navigation key, scroll down to "Measuring time".
Confirm with OK.
Measuring mode is switched on; this is indicated by the tick next to "Measuring mode".



Select the measuring time:

OK

Using the navigation key, scroll down to "Measuring time".
Confirm with OK.

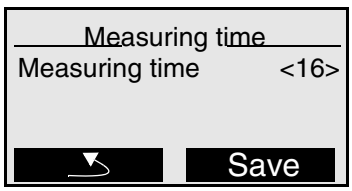


Set the value range:

Press the navigation key: to increase the value range

Press the navigation key: to reduce the value range

Value range: 06 to 16
Recommended value range: 16
(measuring cycle: 1 s to 2.5 s)



Save

Press the Save key to confirm the value range set

Switch off the mobile telephone:

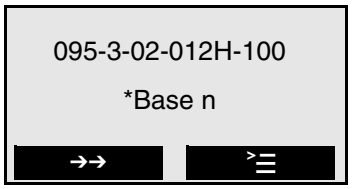
Press the on-hook key until the confirmation beep is heard (ascending tone sequence).

Nothing is displayed

The measurement values are displayed when the mobile telephone is switched on. Measurements are performed at the set intervals (see Section 7.2.1).

Switch on the mobile telephone:

Press the on-hook key until the confirmation beep is heard (ascending tone sequence).



WARNING

Only the specified functions may be activated. Activating other functions may result in malfunctions.

7.2.2.2 Deactivating Measuring Mode

Switch off the mobile telephone:

Press the on-hook key until the confirmation beep is heard (ascending tone sequence).

Nothing is displayed

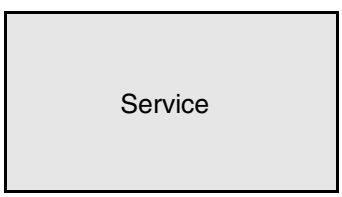
Switch the mobile telephone into service status:

1	2	3
4	5	6
7	8	9
*	0	#

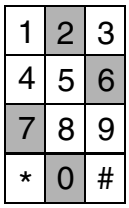
Press keys 1, 4, and 7 simultaneously...

... whilst at the same time...

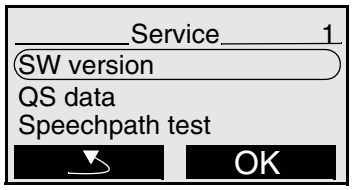
... pressing the on-hook key.



Activate the "Service" menu:

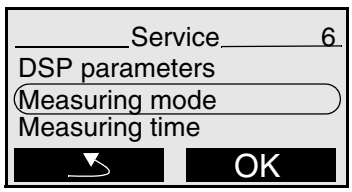


Enter code 76200.



Deactivate the measuring mode:

Using the navigation key, scroll down to "Measuring time".
Confirm with OK.
Measuring mode is switched off; the tick next to "Measuring mode" disappears.



Switch off the mobile telephone:

Press the on-hook key until the confirmation beep is heard (ascending tone sequence).

Nothing is displayed

The measurement values are not displayed if the mobile telephone is switched on.

7.2.3 Documentation of Results

The following points must be documented:

- The installation site of the base stations must be drawn on a customer-specific building/site plan and the base station number (for example, 016 (RPN in measuring mode)) entered.
- Any deviations from existing building and site plans must be verified with the Hicom Cordless Service tool (HCS-DECT) and documented.

WARNING

Any subsequent structural changes within the radio area (buildings, sites, facilities, and devices, etc.) might restrict the operation of the mobile telephones and thus require rearrangement of the base stations.

Examples:

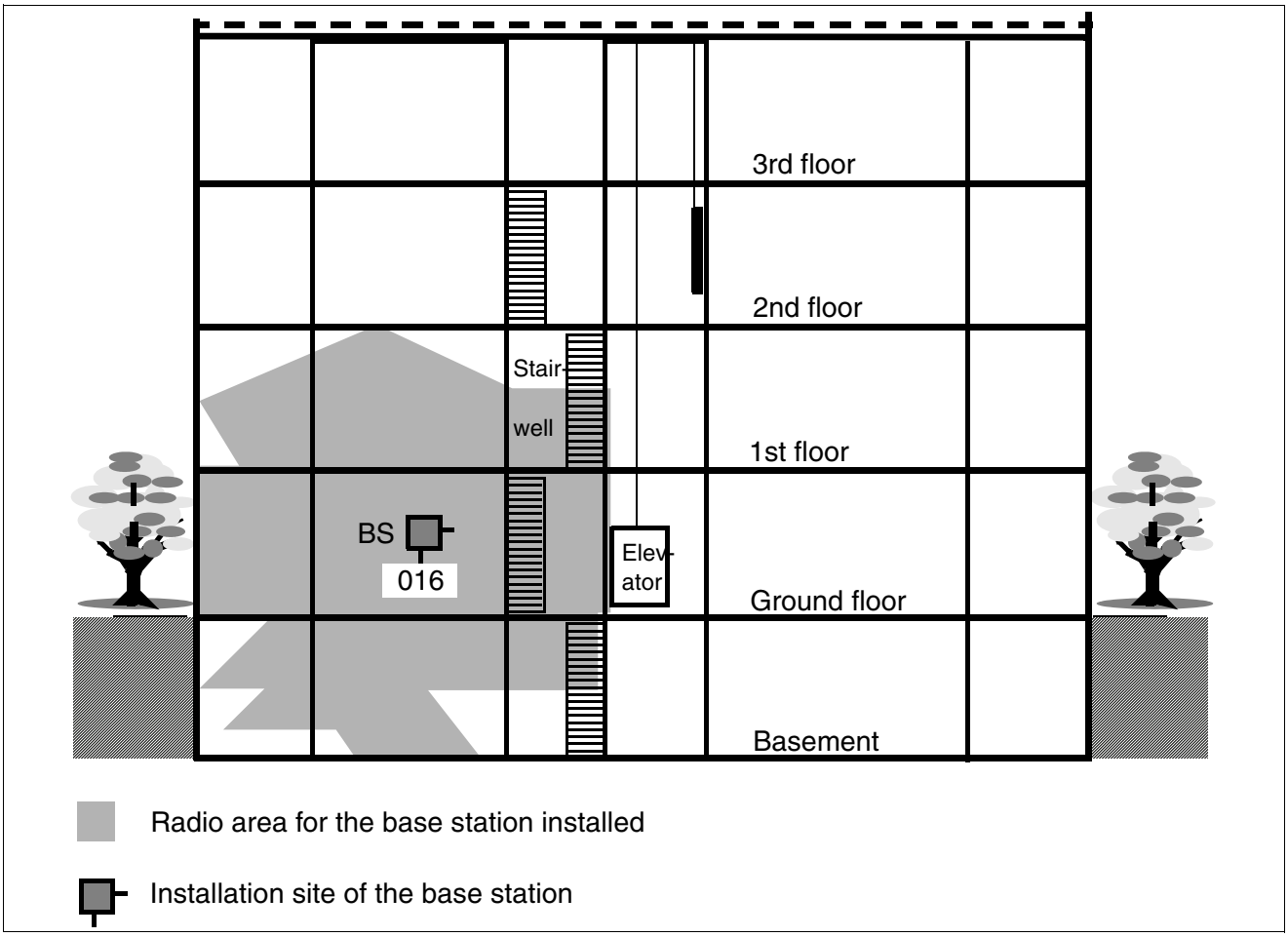


Figure 23 Building - Base station installation site/radio area

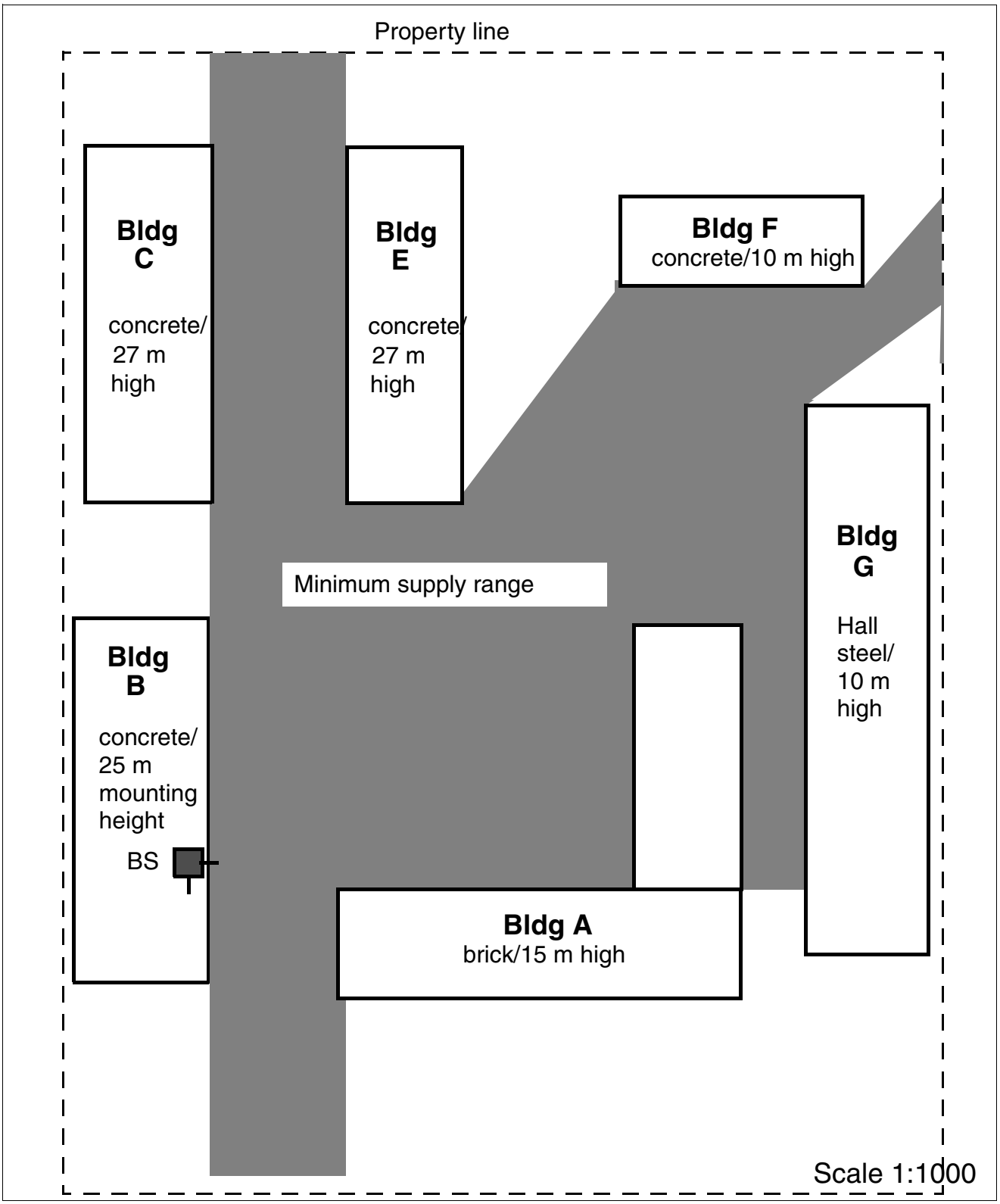


Figure 24 Outdoors - Base station installation site/radio area

7.3 Troubleshooting

7.3.1 Checking HiPath Cordless IP Components

• Entire system	
– Set up call with the mobile telephone	Operating Manual Subjective evaluation of voice connection, for example, background noise
• Check the radio area coverage	See Section 7.1.2 (range warning tone activated)
• DECT IP Base station (BSIP1)	
– LED 1/2	See Section 6.3
– Base station status	PC
– Check active status of base station using the logged-on mobile telephone	**No synchronism:** "Base n" blinks on handset display. **Handset measuring mode is activated:** - Frequency/slot changes - RSSI value If this is not the case, perform the test on a different base station. If it is still unsuccessful, use a different handset. If it is still not possible to synchronize with a base station after repeated attempts, replace the base station.
• Mobile telephone (MT)	
– Logged-on mobile telephone, synchronized with base station	Synchronism symbol "Base n" (name = individual setting) on handset display is continuously visible, does not blink.

7.3.2 What Happens If ...

7.3.2.1 Synchronism Symbol on Handset Display:

– "Base n" flashes

No synchronization to base station

1. Is the mobile telephone not logged on?
2. If the mobile telephone is logged on to multiple systems, is it switched to the correct system? Is automatic system selection activated?
   Check the base station.

– "Base n" continuously visible but no action is possible

Synchronization to base station

1. An error tone can be heard when the line key is pressed.
   Temporary overload status (all the base station speech paths are busy).

   Wait, and try again.
2. Handset was not able to complete the locations request successfully (handset contact to the system).

   Workaround:

   Repeat locations request by switching off the handset and then switching it on again.

7.3.2.2 Handset Cannot Be Reached

1. Handset is called, caller hears ringing (followed by busy signal).

   Causes:
   handset being called is switched off
   OR
   handset is no longer within range
   OR
   the base station used is in overload status and there is no other base station within range.

2. Handset is called, call is always switched to another station.
   Handset has inadvertently activated call forwarding.

7.3.2.3 Connection Handover

– Call disconnected on handover to another base station

1. Check whether or not the base station to which the call is handed over is in overload status (all radio channels busy).
2. Check the base station LEDs.
3. Check the overlap sectors.
   Is the RSSI value of the other base station OK?
4. Check if the two DECT IP base stations involved in the handover operation are synchronous. You can use the Gigaset's measurement mode for this or the synchronism display in the HiPath Cordless IP server software .

7.3.2.4 Handset: Problems Logging On

- Check first if the communication server's IP board and at least one DECT IP base station (in range) are operational.
- Is adequate synchronism guaranteed for the DECT IP base station in the HiPath Cordless IP system?
- Is the handset you want to log on configured on the communication server?
  - Test this with a random phone (optiPoint/OpenStage model).

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